PROPERTY OF
Electro Rent Corporation

9020
RATE PROGRAMMER

Delta Design®
A Cohu Company

# INSTRUCTION MANUAL

MP MASTER
MA32847

DELTA DESIGN, INC.
5775 KEARNY VILLA RD.
SAN DIEGO, CALIFORNIA 92123-1111
TWX: 910 335-1215 • FAX: (619) 277-7884
PHONE: (619) 292-5000

INSTRUCTION MANUAL
9020 RATE PROGRAMMER
Serial Number _____

9020 RATE PROGRAMMER

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ENVIRONMENTAL CONTROL EQUIPMENT FOR RESEARCH AND INDUSTRY
5775 KEARNY VILLA ROAD SAN DIEGO, CALIFORNIA 92123

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# CHAPTER 1
# DESCRIPTION

## 1.1 GENERAL DESCRIPTION

The Delta Design, Inc., 9020 Rate Programmer is a microprocessor based unit which provides the automatic sequencing required in temperature testing and temperature dependent processing. The rate programmer controls temperature parameters related to Rate of Temperature Change, Soak Time (time at a specified temperature), Temperature Setpoint and Deviation Limits, and the Number of Passes. Additionally, three relays are provided for turning external devices on and off. The state of the three relays is programmable for each segment.

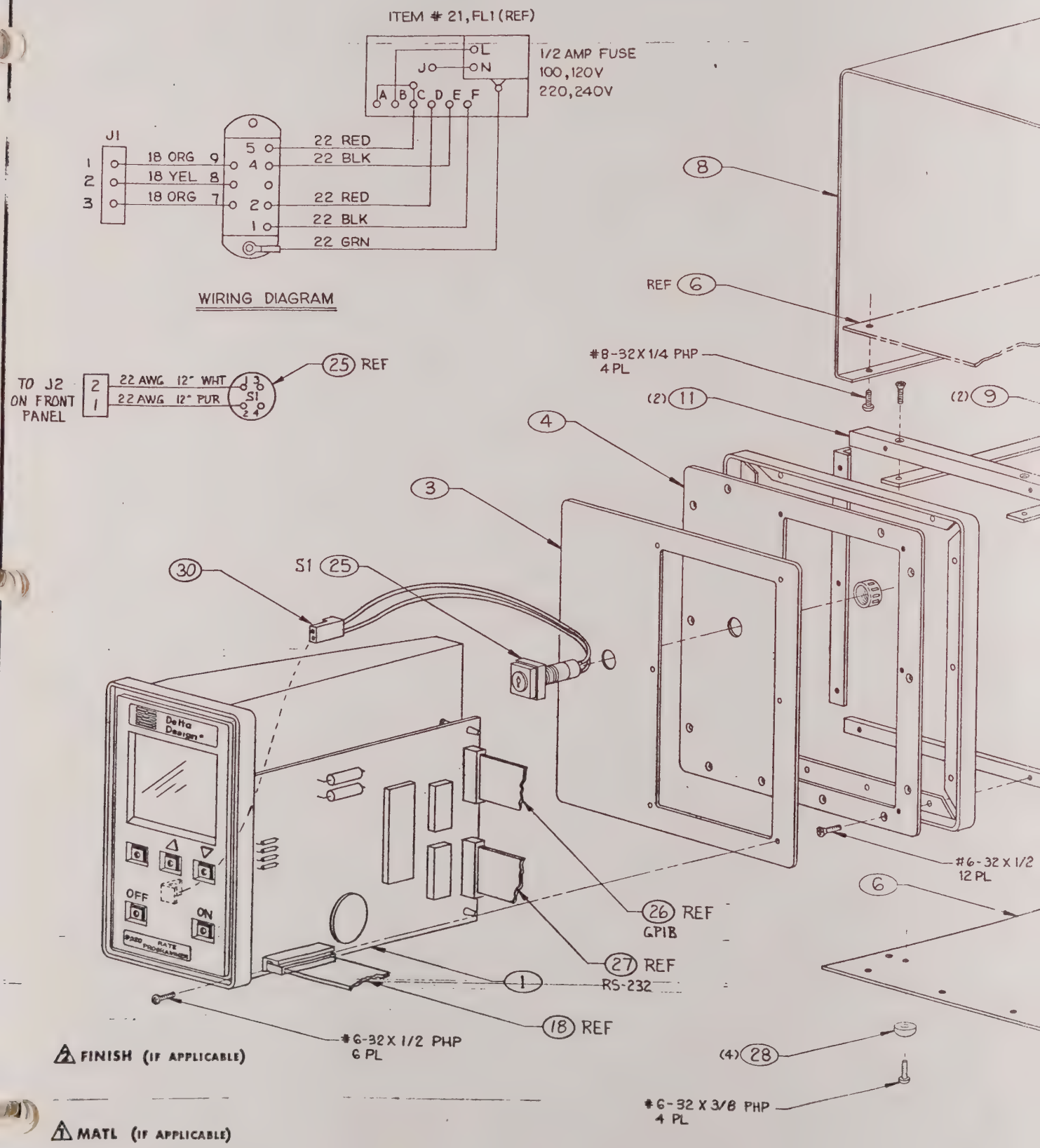
Program parameters are entered by front panel buttons, with data displayed on a custom Liquid Crystal Display (LCD) of two 4-digit numbers and several indicators. The Program is stored in a battery-backed memory in the event of a power loss, and retrieved when power is restored. The program may have up to 30 segments and may be repeated up to 9999 times before being automatically shut down.

A program review function is provided to allow the operator to sequentially step through all program parameters. In the "run" mode, all parameters for the current segment may be displayed without disturbing the operation. Setpoint can range from -184 degrees C to +315 degrees C, with a temperature resolution of 0.1 degree C; soak time from 1 minute to 99 hours, 59 minutes; rate of 60.0 deg/minute maximum; and process deviation limits of 2 degrees to 60.0 degrees.

A front panel "ALARM" indicator will flash on the LCD and the ALARM relay will close whenever the temperature deviates from the programmed soak temperatures set by the limit. It also has a removable key lock switch to safeguard the entered program.

TABLE 1-1. SPECIFICATIONS AND FEATURES

| | |
|---|---|
| POWER | 110/220 VAC, 50/60 Hz |
| SETPOINT | -184.4 to +315.5 degrees C |
| DISPLAY RESOLUTION | 0.1 degree C |
| PROCESS DEVIATION | 2.0 degree C to 60.0 degree C |
| SOAKTIME RESOLUTION | 1 minute |
| SOAKTIME RANGE | 0 to 5999 minutes |
| TEMPERATURE CHANGE RATE | 0.1 degree C minimum to 60.0 degree C maximum/per minute or chamber maximum |
| PROGRAM SEGMENTS | 1 to 30 |
| PROGRAM REPEATS | Settable: 1 to 9999 times |
| EXTERNAL EVENTS | Three independent relay closures, programmable for each segment |
| EXTERNAL EVENT RELAYS | 0.5 amp, 120 VAC, non-inductive |
| ALARM | Flashing LCD alarm and relay closure when process deviation exceeds limits |
| POWER FAULT | Either battery backup or non-volatile memory |
| SIZE | 9" x 10" x 14" |
| WEIGHT | |




⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

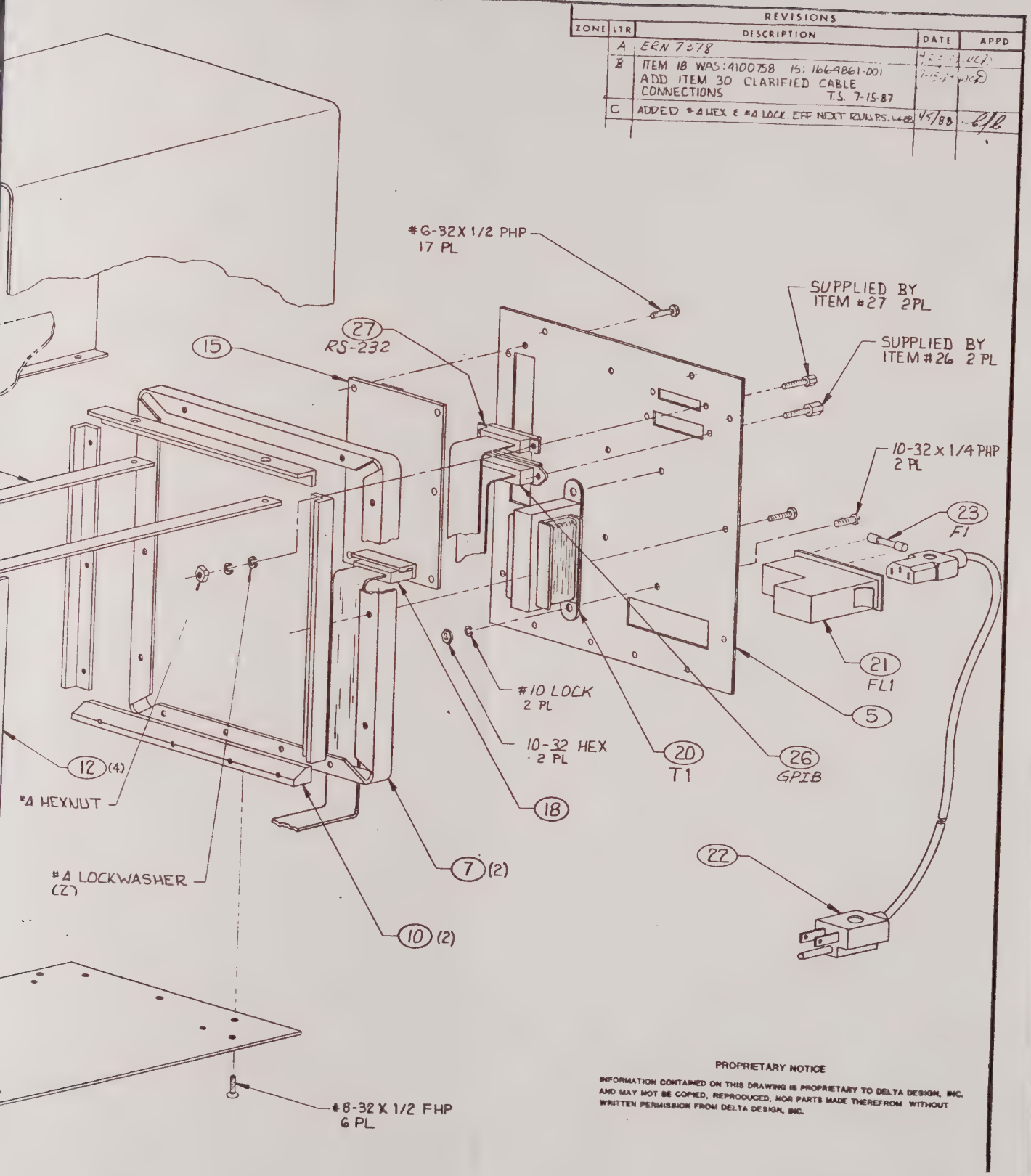

REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPD
A | ERN 7278
B | ITEM 18 WAS: 4100758 IS: 1664861-001 ADD ITEM 30 CLARIFIED CABLE CONNECTIONS T.S. 7-15-87
C | ADDED #4 HEX & #4 LOCK. EFF NEXT RVLL PS. L408 | 4/5/88
#6-32 X 1/2 PHP 17 PL
SUPPLIED BY ITEM #27 2PL
SUPPLIED BY ITEM #26 2 PL
10-32 x 1/4 PHP 2 PL
27 RS-232
15
23 F1
21 FL1
5
#10 LOCK 2 PL
10-32 HEX 2 PL
20 T1
26 GPIB
18
12 (4)
#4 HEXNUT
#4 LOCKWASHER (2)
7 (2)
10 (2)
22
#8-32 X 1/2 FHP 6 PL
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Figure 1-1. 9020 Rate Programmer

# CHAPTER 2
# OPERATION

## 2.1 FRONT PANEL OPERATION

Operation of the Rate Programmer will be described referring to Figure 2-1. The drawing is an attempt to summarize the operation in one page by showing example LCD displays resulting from the possible key sequences.

There are two distinct states, PROGRAM and RUN, selected by the key switch on the front panel. In PROGRAM all six parameters of the thirty possible segments can be viewed and changed. Once the desired program has been entered, turning the key switch to RUN starts automatic control of the 9000 series chamber to follow the program selected.

## 2.2 ENTERING THE CONTROL PROGRAM

The 9020 need not be connected to the 9000 series chamber to enter the control program. The key switch should be in the PROGRAM position at power-on. Figure 2-1 shows that on start-up all the LCD segments will go on and then the program version date code will be displayed, before going to the first display, "A", of the PROGRAM state. LCD display "A" will always start-up at the first segment indicated on the display by -01-. The UP and DOWN keys are then used to get at the segment to view or program. The unmarked FCN key both enters the selected segment number in display "A" and advances to display "B". Further FCN key presses will allow sequential access to the remaining five parameters of the selected segment.

### 2.2.1 PROGRAMMING

Programming, in short, consists of repeating the following until all segments are filled with the desired values:

0: In display "A".
1: Use UP and DOWN keys to select segment to be changed.
2: Use FCN key to get to the parameter to be changed.
3: Use UP and DOWN keys to change the parameter.
4: Use FCN key to return to 0:.

Be aware when programming that if there is no key activity for 15 seconds, the display will switch back to "A" and not enter the changes keyed in for that parameter.

Note that a word indicating which parameter is being viewed appears on the LCD and that the drawing shows, to the right of the display, the range of values that the parameter can have. Display "B", for example, indicates with the word TEMP that the soak temperature for segment #2 (indicated by -02-) has been set to 80.0 degrees C. It shows a range of possible temperatures from -184.4 to 315.5 degrees C.

### 2.2.2 PASS PARAMETER

The final segment in the sequence of consecutive segments will be the only segment with a non-zero PASS parameter. The other parameters in the terminator, except relay outputs, will be ignored. The sequence will be repeated, in order, the number of times entered in the PASS parameter of the terminator segment.

## 2.3 RUN STATE

Before switching to the RUN state, the starting segment must have been selected. It may be any segment that is followed by a terminator. When the sequence repeats after it reaches the terminator, it will always repeat starting at the first step of the sequence containing the starting segment. Remember that the 30 segments may have several terminators marking the end of an equal number of sequences. Selecting the starting segment selects the sequence that will be executed in RUN.

### 2.3.1 "J" DISPLAY

The first display after switching to RUN should be "J", showing the first and last segment numbers of the sequence of segments that are going to be used to control the chamber. If a HELP display appears instead, the number under the HELP on the LCD will give some clue as to what the 9020 found wrong, as noted under the HELP display in Figure 2-1. "J" in the drawing shows, as an example, a first segment of -01- and last of -06-. That means that the starting segment was in the sequence of 1 to 6, and that is the sequence that will be repeated until all passes have been run.

### 2.3.2 "K" DISPLAY

"J" is a momentary display for information only, before going to the main RUN state display "K". At this point the 9020 has commanded the chamber under control to go to the temperature displayed in "K", 80.0 degrees. The effective segment of the sequence is shown below as -02- in the example. The display will not change until the chamber reaches the 80.0 degrees soak temperature, at which time the soak period begins. For the duration of the soak period, the "K" display will show the soak period on the top and the elapsed soak time on the bottom. At the end of the soak period, the next segment in the sequence becomes effective and the temperature with segment number will again be displayed.

The alternation of the main RUN display "K" between temperature and soak time described above, will continue with the last segment looping to the first segment of the sequence, as long as there are more passes to do. After the last pass, the EOP display will show and the control program stops with the event relays as programmed in the terminator segment.

### 2.3.3 PASS DISPLAY

Any time, while in the RUN state, the parameters of all the segments in the sequence may be viewed with no danger of changing any of them. Similar to the programming procedure, the FCN key selects the parameter while the UP and DOWN keys select a segment from the current sequence. The PASS display "P" is an exception however, as it shows the number of passes in the terminator on the top, and the number of passes so far completed on the bottom. The example in Figure 2-1 shows that 50 passes are programmed and so far, 3 passes have been completed. The 9020 may be left in any display mode, as it will snap back to the main display after 15 seconds of key inactivity.

## 2.4 SAMPLE PROGRAM

The 9020 is delivered with the default program that is a minimum valid program. It consists of the following two segments:

| PARAMETER | SEG #1 | SEG #2 | |
|---|---|---|---|
| TEMP | 55.0 | 0.0 | Degrees C |
| SOAK | :01 | :00 | Minutes |
| RATE | 5.5 | 0.0 | Degrees C / Minute |
| OUTPUT | 111 | 000 | 1 => ON, 0 => OFF |
| LIMIT | 5.0 | 5.0 | Degrees C |
| PASS | 0 | 1 | Pass |

This program will take the chamber from the start temperature (near ambient) at 5.5 degrees per minute, up to 55 degrees and leave it there one minute before ending. The three relay outputs are closed during segment #1 only.

The default program above is useful for checking out the 9020 to 9000 series chamber operation, while still unfamiliar with the front panel operation.

## 2.5 NORMAL OPERATION

With the 9020 connected to the 9000 series chamber to be controlled, normal operation would be as outlined in Figure 2-2. The chamber should be turned on first, then the 9020 with the key switch in PROGRAM. The first three displays will appear in the sequence shown. Switching the key to RUN then, will run the control program to the end with no further operator assistance.

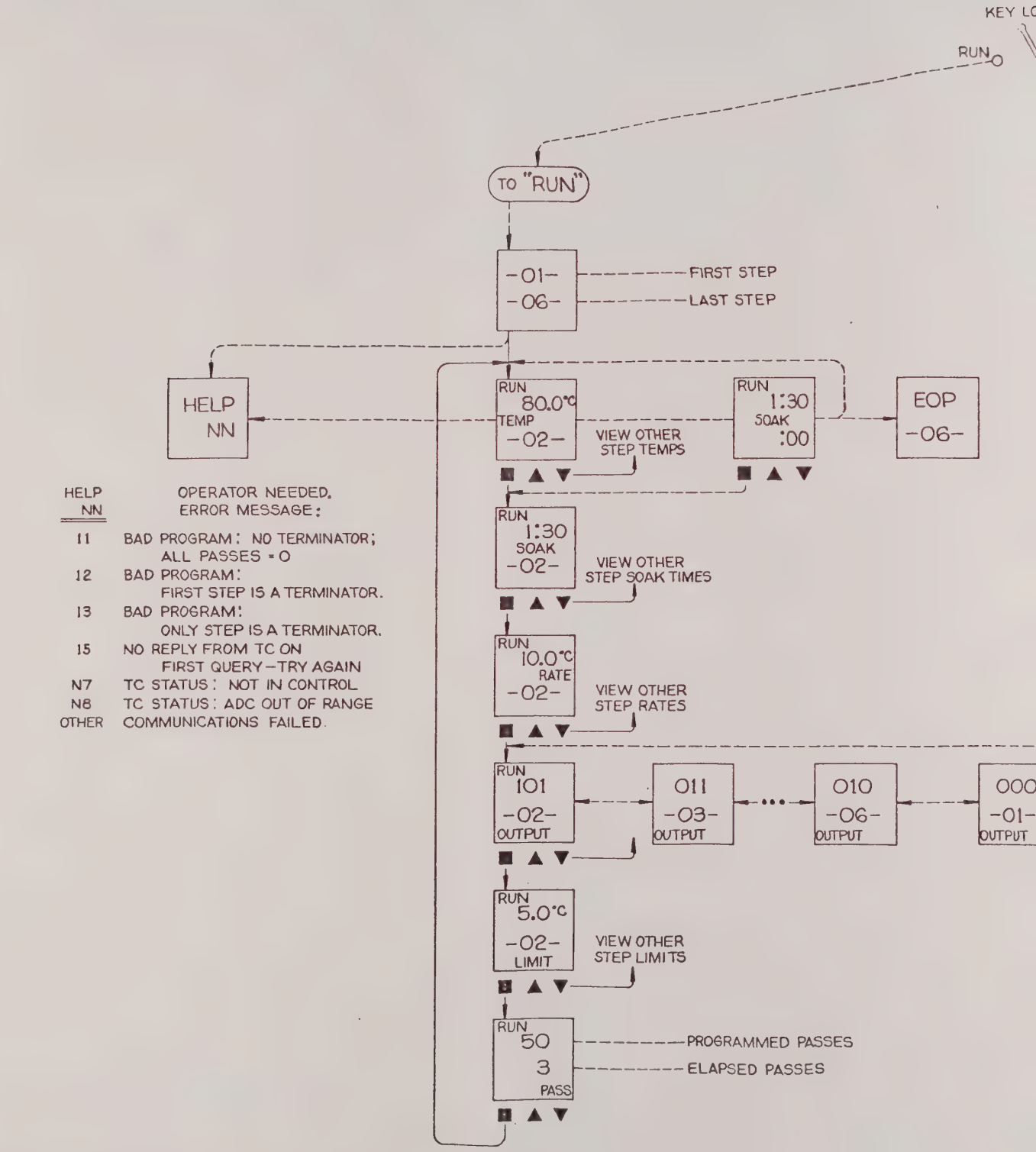
A sketch of the default program is shown in Figure 2-3. A more realistic example of a program is diagrammed in Figure 2-4. It corresponds to the following:

| PARAMETER | SEG #1 | SEG #2 | SEG #3 | SEG #4 | |
|---|---|---|---|---|---|
| TEMP | 55.0 | 75.0 | 85.0 | 00.0 | Degrees C |
| SOAK | :01 | :00 | :03 | :00 | Minutes |
| RATE | 5.5 | 0.0 | 3.0 | 0.0 | Degrees C / Minute |
| OUTPUT | 001 | 010 | 011 | 000 | 1 => ON, 0 => OFF |
| LIMIT | 5.0 | 5.0 | 5.0 | 5.0 | Degrees C |
| PASS | 0 | 0 | 0 | 2 | Pass |

### 2.5.1 ZERO SOAK/RATE

Note that in segment #2 both the soak time and the rate are zero. A zero rate is interpreted as NO RATE CONTROL; the chamber will go to the segment temperature at its maximum rate. A zero soak time ends the segment as soon as the segment temperature is reached.

The terminator (segment #4) has its PASS parameter set to 2, which causes a second pass through the sequence of segments #1, #2 and #3.




| HELP NN | OPERATOR NEEDED. ERROR MESSAGE: |
|---|---|
| 11 | BAD PROGRAM: NO TERMINATOR; ALL PASSES = 0 |
| 12 | BAD PROGRAM: FIRST STEP IS A TERMINATOR. |
| 13 | BAD PROGRAM: ONLY STEP IS A TERMINATOR. |
| 15 | NO REPLY FROM TC ON FIRST QUERY—TRY AGAIN |
| N7 | TC STATUS: NOT IN CONTROL |
| N8 | TC STATUS: ADC OUT OF RANGE |
| OTHER | COMMUNICATIONS FAILED. |

⚠2 FINISH (IF APPLICABLE)

⚠1 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

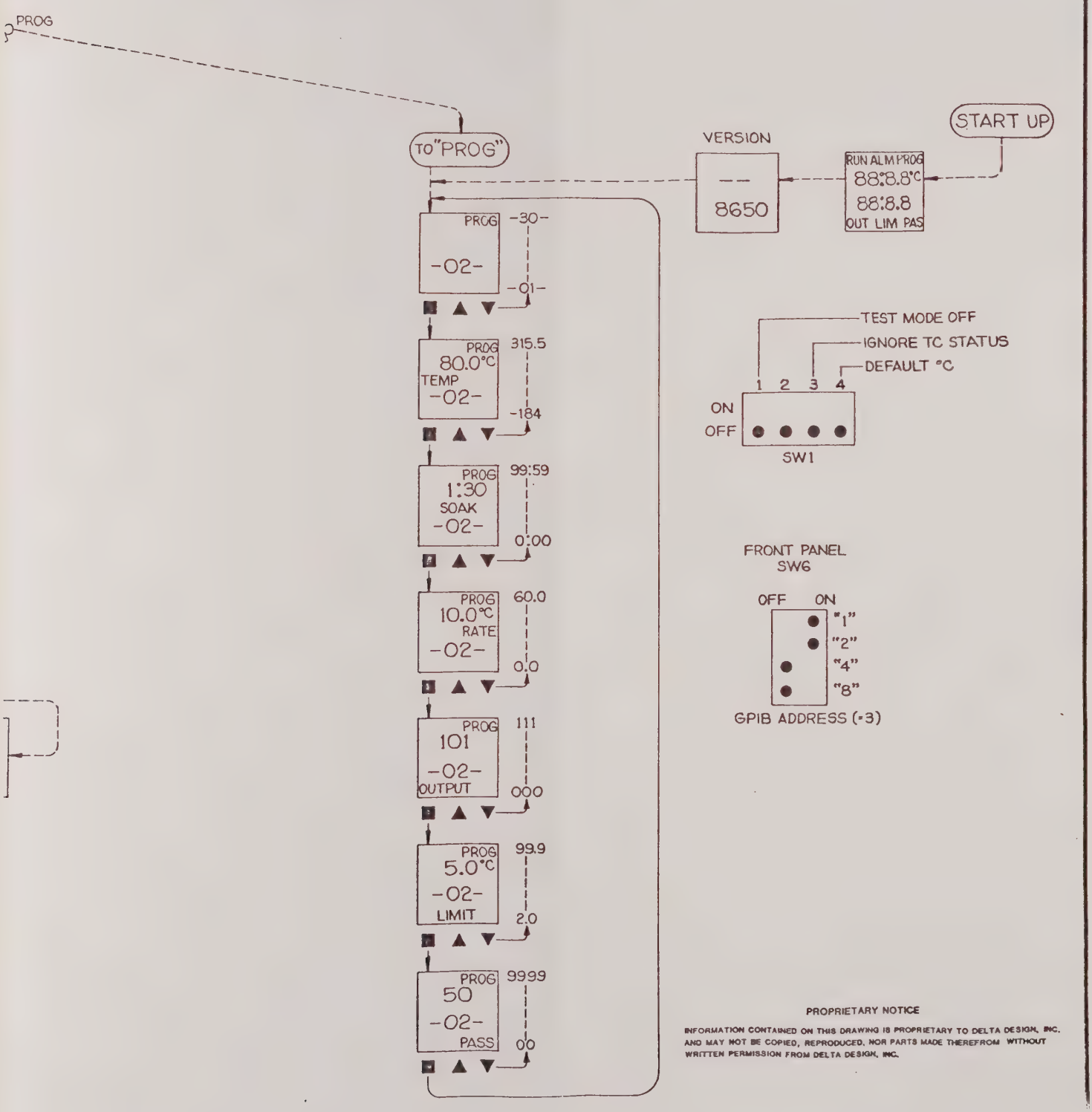



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Figure 2-1. Rate Programmer Operation

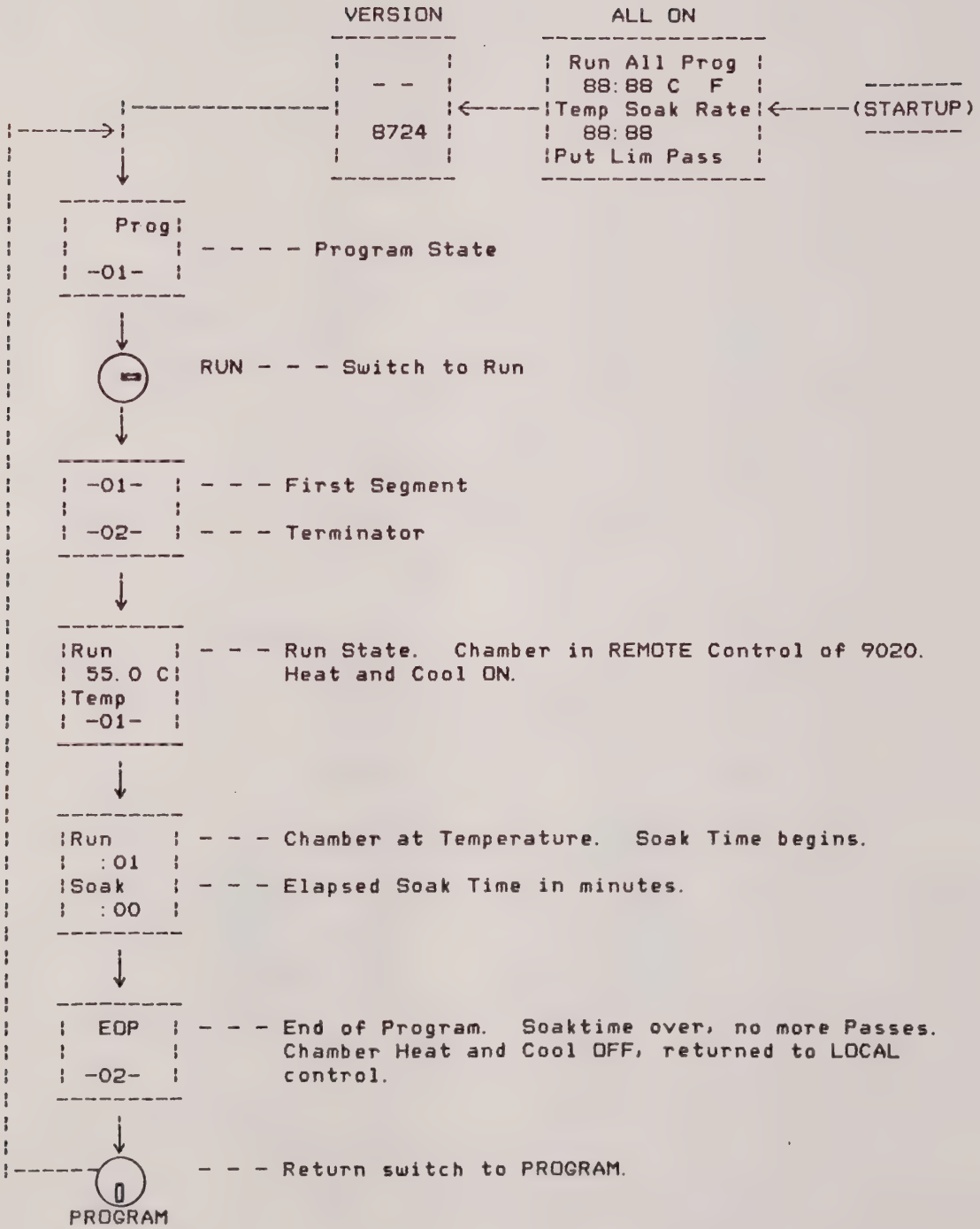
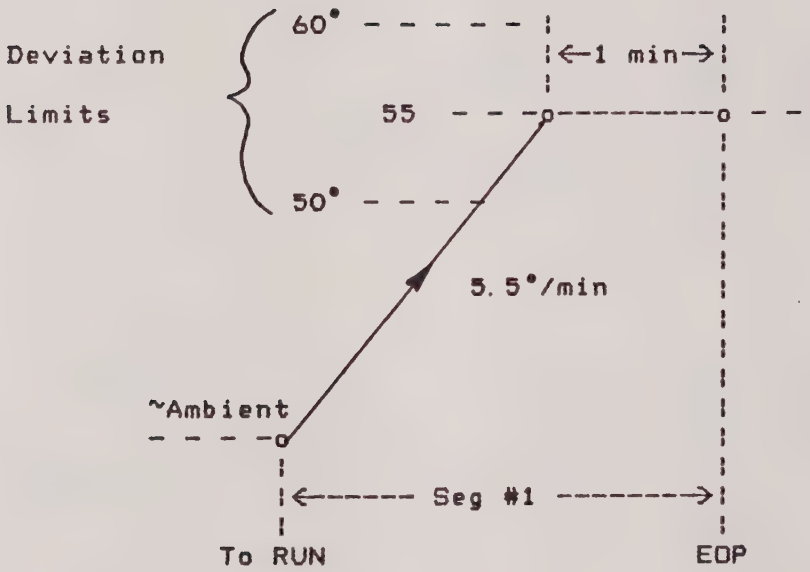



Figure 2-2. Operation With Default Program




| | SEG #1 | SEG #2 |
|---|---|---|
| Temp | 55.0 | 0.0 |
| Soak | :01 | :00 |
| Rate | 5.5 | 0.0 |
| Output | 111 | 000 |
| Limit | 5.0 | 5.0 |
| Pass | 0 | 1 |

Figure 2-3. Default Program

| | SEG #1 | SEG #2 | SEG #3 | SEG #4 | |
|---|---|---|---|---|---|
| TEMP | 55.0 | 75.0 | 85.0 | 0.0 | °C |
| SOAK | :01 | :00 | :03 | :00 | Min |
| RATE | 5.5 | 0.0 | 3.0 | 0.0 | °C/min |
| OUTPUT | 001 | 010 | 011 | 000 | 1=>ON |
| LIMIT | 5.0 | 5.0 | 5.0 | 5.0 | °C |
| PASS | 0 | 0 | 0 | 2 | Passes |

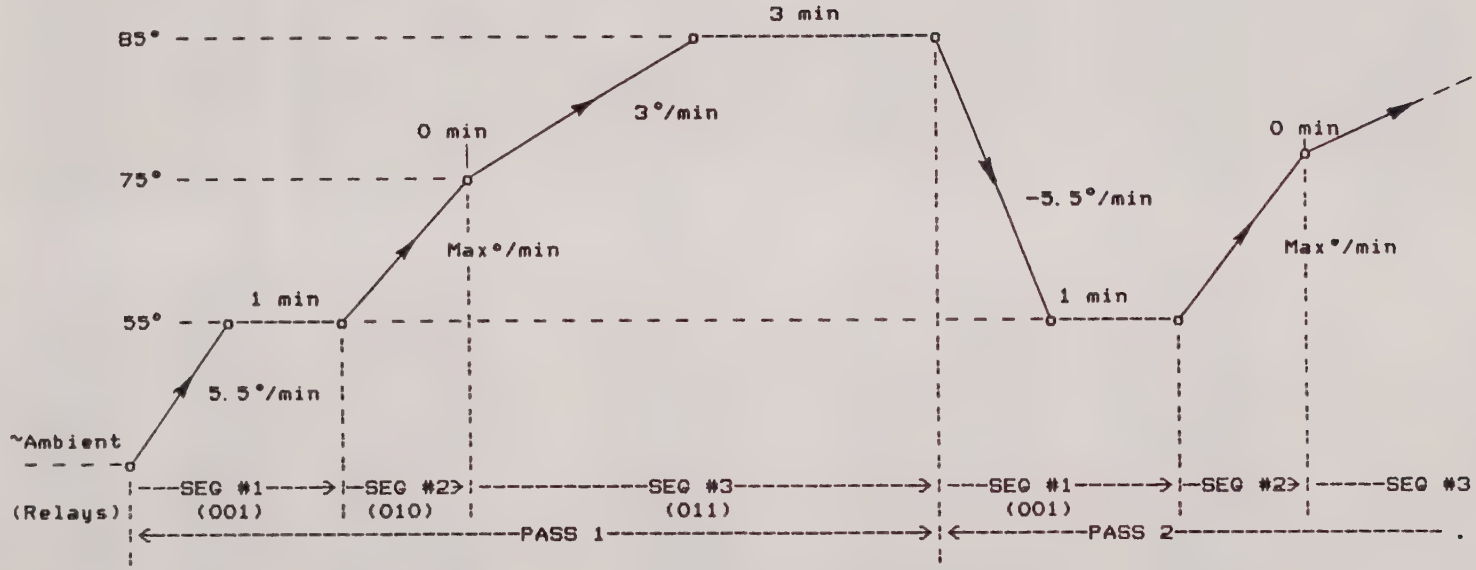



Figure 2-4. Example Program

# CHAPTER 3
# REMOTE OPERATION

## 3.1 REMOTE OPERATION OF THE DELTA 9020

The GPIB connector on the rear of the 9020 provides IEEE-488 interface with the Rate Programmer. The command list described below allows for downloading a program to the 9020 and monitoring operating parameters while a rate programmer is running.

### 3.1.1 GPIB ADDRESS

When shipped, the GPIB address is the default value of 26. The address may be changed by setting the dip switches (SW6) on the front panel printed circuit board to a value other than zero. The four switches allow for address selection from 1 to 15, as the switches are valued at "1", "2", "4" and "8" from top to bottom.

### 3.1.2 PROGRAM EXAMPLE (Figure 3-1)

The GPIB is most often used to control a test system composed of several instruments. The following example (Figure 3-1) assumes an HP-85 as the control computer and the 9020 as the sole instrument to illustrate how the commands may be used.

### 3.1.3 LIST OF 9020 COMMANDS (Table 3-1)

The ^s (carets) highlight the necessary command characters, the other letters are optional. In the first command below, "V?" would suffice, but "Version?", "VER?" or "v?" would all be acceptable. "Ver ?" "VERSION" are unacceptable and will be ignored. The question mark is required and cannot be spaced from the command word.

In response to this query, the 9020 will send back a number such as "8723". This number identifies the program version with the date: the 23rd week of the year 1987.

Note that all replies to queries are numbers, either integer or real in the form of a string of ascii characters terminated by CR and LF characters.

```
100 DISP "Sample 9020 - GPIB program."
101 DISP "9020 'ON' and in 'PROGRAM'."
105 !
110 A = 26                    !Address of the 9020.
115 Z = 700 + A              !Prefix with device select number.
120 OUTPUT Z; "STEPCLEAR" !Clear all steps.
121                          !Download a five step program.
122 !
123 ! #1: From present temp to 50 deg. at max rate,
                soak 30 mins.
124 ! #2: From 50 to 88 deg. at 6 deg/min, soak 30 mins.
125 ! #3: From 88 to 125 deg. at 6 deg/min, no soak time.
126 ! #4: From 125 to 160 deg. at 2 deg/min, soak 90 mins.
127 ! #5: Terminator step: Passes = 2; do steps 1,2,3,4
                once more.
128 !
130 OUTPUT Z; "STEP 1,    50.0,   30,    0,    1,    5,    0"
140 OUTPUT Z; "STEP 2,    88.0,   30,    6,    2,    5,    0"
150 OUTPUT Z; "STEP 3,   125.0,    0,    6,    3,    5,    0"
160 OUTPUT Z; "STEP 4,   160.0,   90,    2,    4,    5,    0"
170 OUTPUT Z; "STEP 5,       0,    0,    0,    0,    5,    2"
180 !
190 DISP "Program sent ... Go to RUN when ready."
200 WAIT 1000
210 OUTPUT Z; "STATE?"
220 ENTER Z; S               !Wait for 9020 state change.
230 IF S = 1 THEN 200
240 !
250 DISP "Program running."
260 END
```

Figure 3-1. Example Program

TABLE 3-1
9020 COMMAND LIST

| COMMAND | |
|---|---|
| Version?<br>^ ^ | Get version number (year,week),<br>ie: 8723.<br>This is the same number that<br>appears on the LCD at power-up. |
| State?<br>^ ^ | Get the current state of the 9020:<br>0: Start-up.<br>1: Program.<br>2: Going from Program to Run.<br>3: Call for Help.<br>4: Run to soak temperature.<br>5: Soaking at temperature.<br>6: Going from Run to Program.<br>7: End of Program. |
| STEPNumber?<br>^^^^^ ^ | Get the current step of the<br>program, a number from 1 to 30. |
| SOaktime?<br>^^ | Get the elapsed time soaking at<br>temperature in minutes from 1 to 5999. |
| PAssnumber?<br>^^ ^ | Get the number of elapsed passes of<br>the sequence of steps from 0 to 9998. |
| TStep? N<br>^^ ^ ^ | Get the step N temperature in degrees<br>C. Temperature from -184.4 to<br>315.5 C. |
| TStep N, nnn.n<br>^^ ^ ^ | Enter the step N temperature in<br>degrees C. |
| SStep? N<br>^^ ^ ^ | Get the step N soak time in minutes.<br>Time from 1 to 5999 minutes (100 hours). |
| SStep N, ssss<br>^^ ^ ^ | Enter the step N soak time in minutes. |
| RStep? N<br>^^ ^ ^ | Get the step N control rate in degrees<br>C per minute from 0 to 60.0. |
| RStep N, nn.n<br>^^ ^ ^ | Enter the step N control rate. |

TABLE 3-1 (CONTINUED)

| COMMAND | |
|---|---|
| OStep? N<br>^^ ^ ^ | Get the three output relay states for step N. The single digit reply is the octal value of the three states: a 3 => 011 where a '0' indicates 'open' and a '1' indicates 'closed'. The order is as shown on the rear panel of the 9020 cabinet. |
| OStep N, n<br>^^ ^ ^ | Enter the octal value for the relays in step N. |
| LStep? N<br>^^ ^ ^ | Get the temperature deviation in degrees C allowed during soaking. From 2 to 60.0 degrees can be entered as the limit. Any temperature outside the band plus and minus limit, will flash the ALARM on the LCD and cause the ALARM relay to close. |
| LStep N, nn.n<br>^^ ^ ^ | Enter the limit parameter for step N. |
| PStep? N<br>^^ ^ ^ | Get the pass parameter for step N. It should be zero for all but terminator steps. A terminator step is any step with a non-zero pass parameter. The sequence of steps from one terminator to another will be repeated as many times as is in the pass parameter that terminates the sequence. It can be from 1 to 9999 repeats. |
| PStep N, nnnn<br>^^ ^ ^ | Enter the pass parameter for step N. |
| Step? N<br>^ ^ ^ | Get all six parameters for step N. |
| Step N, nnn.n, ssss, rr.r, o, 1.1, pppp<br>^ ^ ^ ^ ^ ^ ^ ^ ^ | Enter all six. |
| STEPClear<br>^^^^^ | Clear the temperature, soak time, rate, outputs and passes to zero for all steps. Make the limit for all, 5.0 degrees C. |
| Degrees Celcius<br>^ ^ | Front panel display and entry in C. |
| Degrees Fahrenheit<br>^ ^ | Front panel display and entry in F. |

# CHAPTER 4
# MAINTENANCE

## 4.1 GENERAL

There are no periodic adjustments or maintenance checks on the 9020 hardware. The built-in test features described below may be useful in case of apparent malfunction.

### 4.1.1 TEST MODE

This mode should only be activated by maintenance personnel. When DIP switch SW1-1 on the main board is in the ON position, none of the previous modes apply; a special test program runs instead.

NOTE

During this test all output lines are toggled.

On startup the LCD will show all the annunciators (the non-digits) and either "7777" or "----" for both the four digit displays. The "7777" indicates that the RAM test passed; "----" that it failed. The test program does not use the RAM. Pressing the UP key will cause all digits to step up thru the "B" code (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, -, E, H, L, P). Pressing the DOWN key steps down thru the "B" code. Pressing the other key will toggle the annunciators off and on.

Connecting a terminal (set for 9600 baud) permits further testing. The jumpers at J7 on the main PC board should be changed to connect 1 to 2 and 3 to 4, for this test. On start up "ROM only 1/87" appears on the terminal, followed by a report on the RAM test. Pass or fail, the program then goes into an endless loop sending ".+.+.+.+.+.+.+.+.+.+.+...." to the terminal until the program is stopped. The "+" will be replaced by any printable key pressed on the terminal, to check both directions of communication over the RS-232C lines. In addition, the four output lines are toggled independently, causing the four relays to turn on and off rapidly.

### 4.1.2 CLEARING ALL RAM

The back-up circuit and three volt lithium battery keep the low power CMOS Random Access Memory alive when power is off. On power-up, this RAM is cleared to zeros except for a portion in which the operating parameters are saved.

If for some reason this section gets polluted, there is a way to clear all of RAM to zero, and then load in nominal initial values for the parameters. At the front panel, with the power off, hold down the FCN, UP and DOWN keys with one hand and press the ON key. The display will blank out until the three keys are released, then it will go thru its normal start-up sequence.

If the battery back-up fails, a similar sequence will be seen during start-up.

## 4.2 INITIAL SETUP FOR SERVICING

WARNING

ENSURE THAT ALL SOURCES OF POWER HAVE BEEN REMOVED FROM THE EQUIPMENT PRIOR TO INSTALLING, REMOVING OR SERVICING THE PROGRAMMER.

CAUTION

SOME COMPONENTS USED ON THE PROGRAMMER PC BOARD ARE STATIC CHARGE SENSITIVE. UNNECESSARY HANDLING SHOULD BE AVOIDED. REMOVAL OF COMPONENTS FROM THIS BOARD WILL VOID THE PROGRAMMER WARRANTY.

### 4.2.1 ELECTRICAL CONNECTION (Figure 4-1)

Electrical connection is made between the key lock switch on the front of the Rate Programmer and J2 on the Front Panel PC board, and from J1 on the Front Panel PC board to J3 on the Single Channel Temp Controller PC board. Connection is then made between J10 on the Single Channel PC board and J2 on the Rate Programmer Relay PC board. Another connection is made between J1 on the Relay PC board and pins 7, 8, and 9 on the Transformer mounted on the inside of the back panel of the programmer. TB1 is mounted through the backside of the programmer rear panel and is part of the Relay PC board. TB1 allows connections for the ON/OFF relay, ALARM relay, and EVENT relays. The Single Channel PC board also has the GPIB (J2) and RS-232 (J9) connections on it, with external connectors on the rear panel of the programmer.

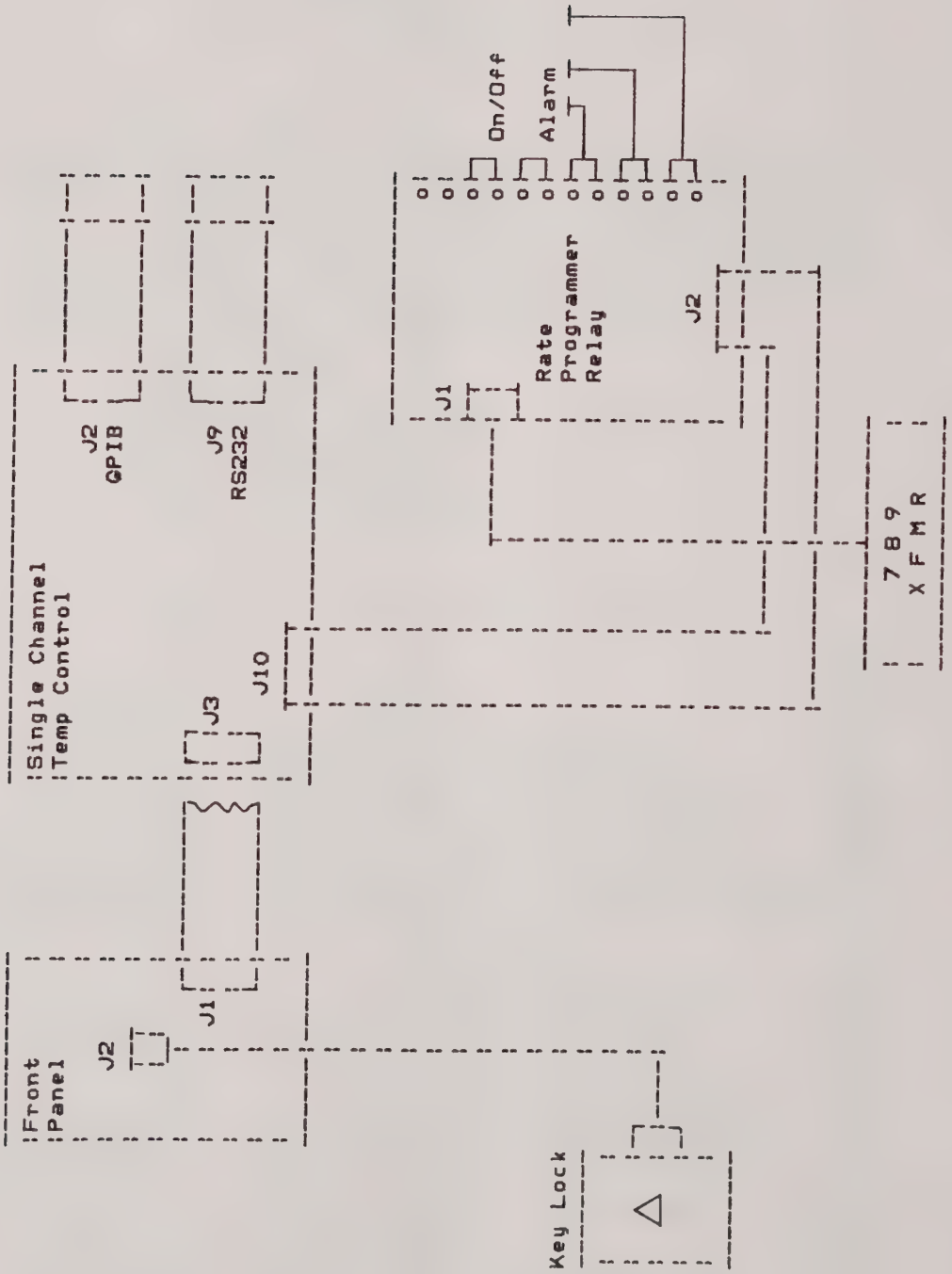



Figure 4-1. Electrical Connections

# CHAPTER 5
# DRAWINGS AND PARTS LISTS

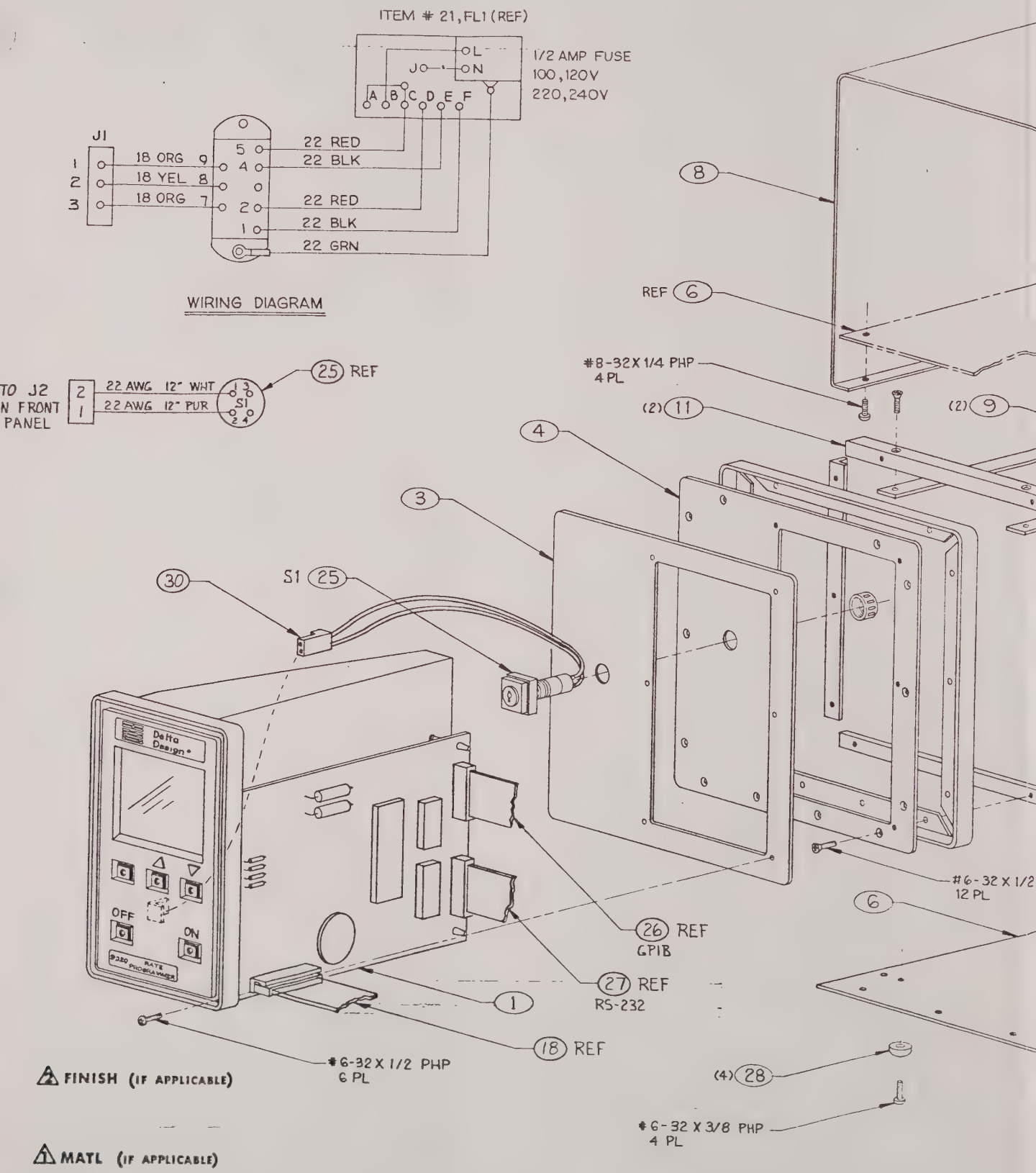
## 5.1 HOW TO USE

This section contains the drawings and parts lists associated with the 9020 Rate Programmer, and are listed in order of Top Assembly on down. Refer to these drawings whenever necessary for troubleshooting and repair, or when ordering parts. Please contact the Delta Design, Inc., Customer Service Department if more information is required.

DELTA DESIGN, INC.
5775 KEARNY VILLA RD.
SAN DIEGO, CALIFORNIA 92123-1111
TWX: 910 335-1215
FAX: (619) 277-7884
PHONE: (619) 292-5000

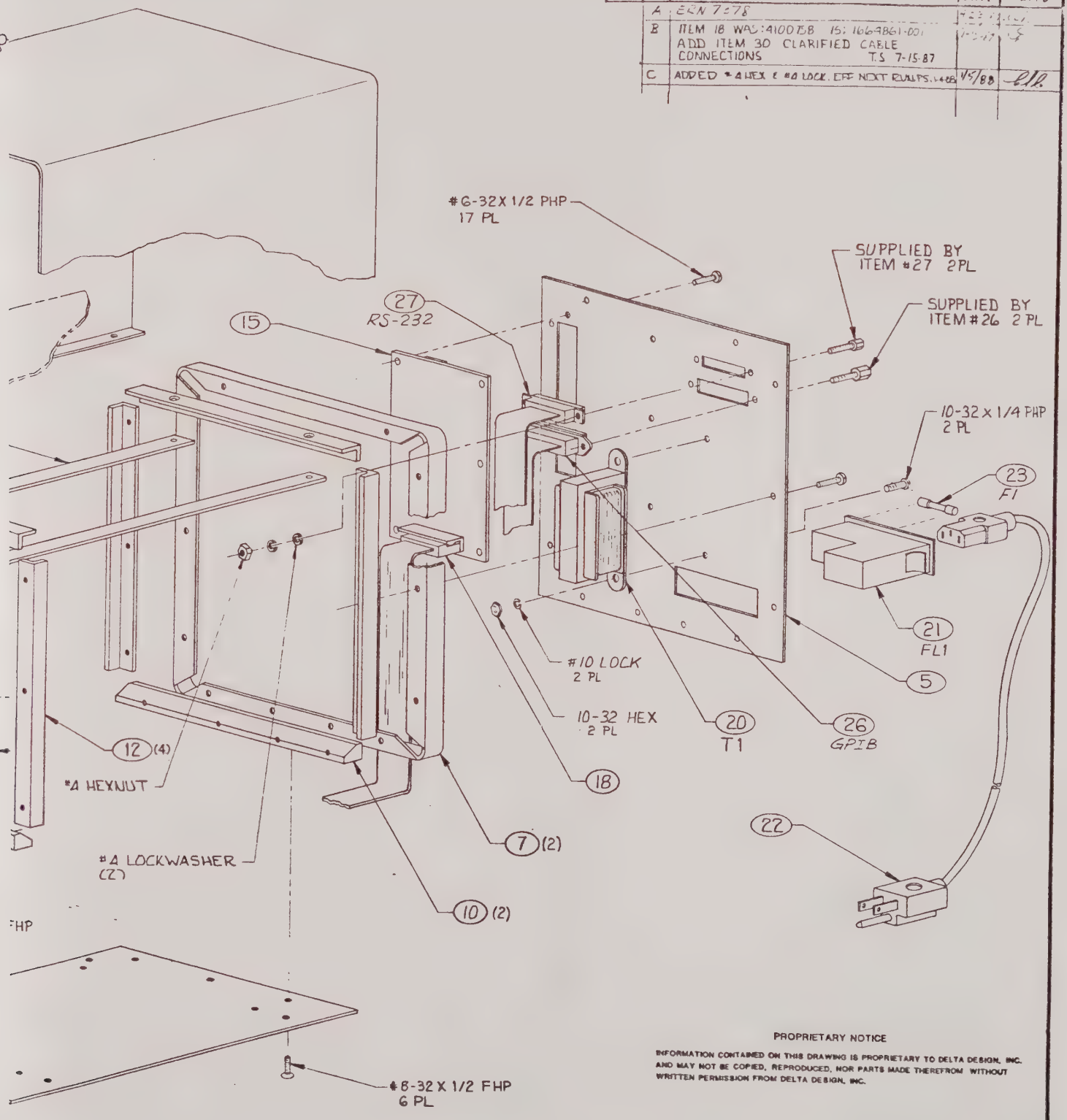
TABLE 5-1. DRAWINGS AND PARTS LISTS


| PART NUMBER | DESCRIPTION | PAGE |
|---|---|---|
| 1664477-001 | 9020 Rate Programmer | 5-2 |
| 1664477-001 | Parts List, Rate Programmer | 5-3 |
| 1663049-002 | Front Panel Assembly, Rate | 5-4 |
| 1663049-002 | Parts List, Front Panel Assy | 5-5 |
| 1661866-502 | PWB Assy, Front Panel Control | 5-6 |
| 1661866-502 | Parts List, Front Panel Control | 5-7 |
| 1662239-000 | Schematic, Front Panel Rate Prog | 5-8 |
| 1666279-001 | Parts List, Cable Assy, Backlight | 5-9 |
| 1661250-501 | PWB Assy, Single Channel Temperature Controller | 5-10 |
| 1661250-501 | Parts List, Single Channel | 5-11 |
| 1661247-000 | Schematic, Single Channel Temperature Controller | 5-13 |
| 1663606-501 | PWB Assy, Rate Programmer Relay | 5-14 |
| 1663606-501 | Parts List, Rate Programmer Relay | 5-15 |
| 1663604-000 | Schematic, Rate Programmer Relay | 5-16 |
| 1665275-001 | Transformer Assembly | 5-17 |
| 1665275-001 | Parts List, Transformer Assy | 5-18 |
| 1664574-001/051 | Cable Assembly, GPIB/RS-232C | 5-19 |
| 1664574-001 | Parts List, Cable Assy GPIB | 5-20 |
| 1664574-051 | Parts List, Cable Assy RS232C | 5-21 |
| 1664861-001 | Cable Assembly, Auxiliary Mod | 5-22 |
| 1664861-001 | Parts List, Cable Assy Aux Mod | 5-23 |




NOTES: UNLESS OTHERWISE SPECIFIED

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPD |
| | A | ERN 7378 | | |
| | B | ITEM 18 WAS: 4100758 IS: 1664861-001<br>ADD ITEM 30 CLARIFIED CABLE<br>CONNECTIONS T.S 7-15-87 | | |
| | C | ADDED *A HEX & #0 LOCK. EFF NEXT REVAPS. | 4/5/88 | |

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| DASH | QTY | NEXT ASSY | USED ON | SERIAL NO. | DATE EFF | DWG REV |
|---|---|---|---|---|---|---|
| DC1 | 1 | END ITEM | | | | |

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0° 30'
HOLE TOLERANCES

MATERIAL

ENGINEERING ACTIVITY: ERN 7378

| | | |
|---|---|---|
| DESIGN | | |
| DRAFTED | E. SAMSON 3-12-87 | |
| CHECKED | | |
| APPROV | | 4/23/87 |
| RELEASE | | |

Delta Design
8778 KEARNY VILLA RD.
SAN DIEGO, CA
92123 -1111

TITLE: 9020
RATE PROGRAMMER

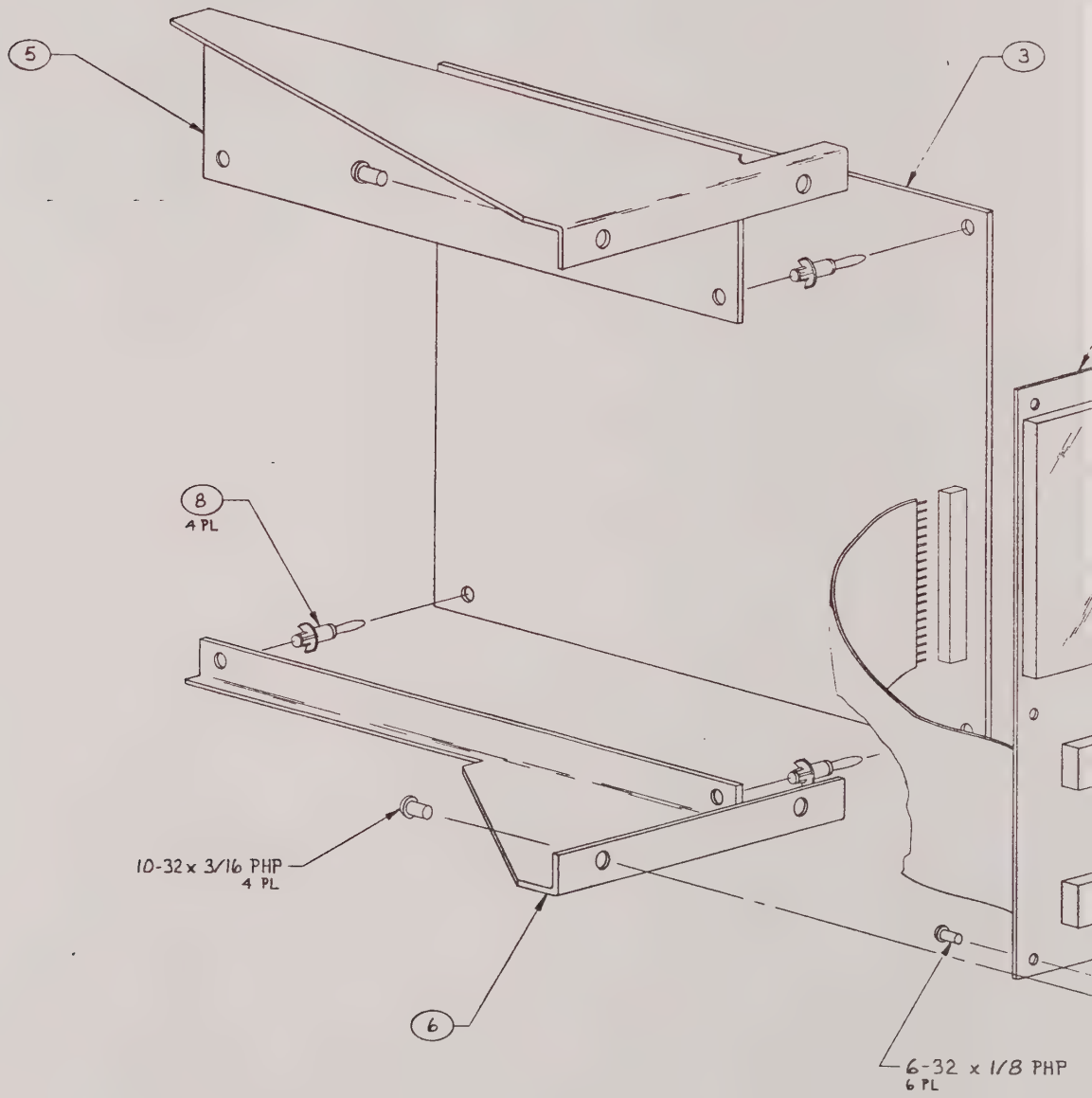
SIZE: D | CODE IDENT | 1664477 | REV

5-3

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY 1664477001
DESCRIPTION: 7020 RATE PROGRAMMER
REF/DES

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 1663049002 | FRONT PNL ASSY, RATE PROGRAMMER | | 1 |
| 003 | 1662401101 | FACE PLATE FRT PNL | | 1 |
| 004 | 1662402101 | BACK PLATE FRT PNL | | 1 |
| 005 | 1662403101 | REAR PANEL | | 1 |
| 006 | 1662400101 | BASE PLATE | | 1 |
| 007 | 1662399101 | END PLATES RATE PROG | | 2 |
| 008 | 1662398101 | COVER RATE PROG | | 1 |
| 009 | 1662405101 | UPPER BRACE | | 2 |
| 010 | 1662407101 | BOTTOM SUPPORT | | 2 |
| 011 | 1662406101 | TOP SUPPORT | | 2 |
| 012 | 1662404101 | SIDE SUPPORT | | 4 |
| 015 | 1663606501 | PWA-RATE PRG RELAY | | 1 |
| 020 | 1665275001 | TRANSFORMER ASSY | | 1 |
| 021 | 1400449 | FILTER RFI POWER LINE | FL1 | 1 |
| 022 | 1501413 | CORD, POWER | | 1 |
| 023 | 1400025 | FUSE, SLO-BLO, 1/2 AMP | F1 | 1 |
| 025 | 1401062 | SWITCH, KEY LOCK | S1 | 1 |
| 026 | 1664574001 | CABLE ASSY, GPIB 12" | | 1 |
| 027 | 1664574051 | CABLE ASSY, RS232, 12" | | 1 |
| 028 | 1500418 | FOOT, RUBBER, MTG. | | 4 |
| 029 | 1664861001 | CABLE ASSY-AUX MOD TO TEMP CONTROL | | 1 |
| 030 | 2000405 | CONN PLG 2P 22G .100 | | 1 |

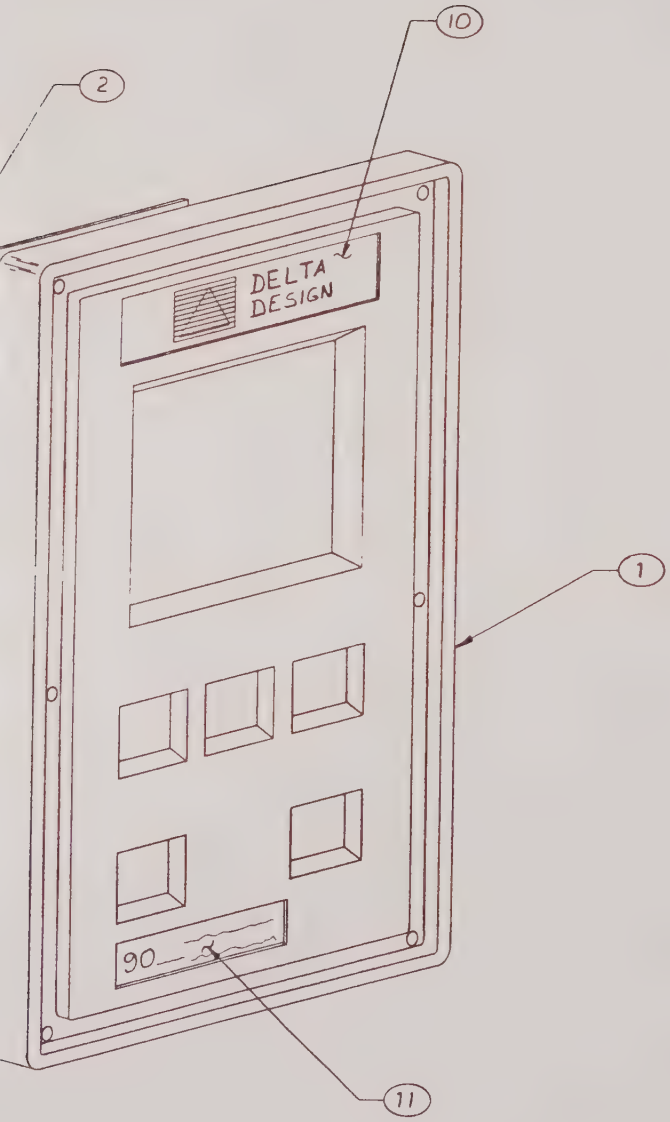



⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPD |
| | A | ERN 7363 | | |




UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS
.XX ± .03
.XXX ± .010
ANGLES
6° 30'

HOLE TOLERANCES

| | | | |
|---|---|---|---|
| .013 THRU .128 | +.004 -.001 | .281 THRU .500 | +.006 -.001 |
| .236 THRU .250 | +.008 -.001 | .501 THRU .750 | +.008 -.001 |

| PASH | QTY | NEXT ASSY | USED ON | SERIAL NO. | DATE EFF | DWG REV |
|---|---|---|---|---|---|---|
| APPLICATION | | | | EFFECTIVITY | | |

MATERIAL ⚠
FINISH ⚠

ENGINEERING ACTIVITY
ERN 7363

| | |
|---|---|
| DESIGN | |
| DRAFTED | T. SHEPARD 9-11-86 |
| CHECKED | |
| APPROV | |
| RELEASE | |

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF CONU INC.
SAN DIEGO, CA. 92123

TITLE: TEMPERATURE CONTROLLER ASSY

| SIZE | CODE IDENT | | REV |
|---|---|---|---|
| D | | 1663049 | F |

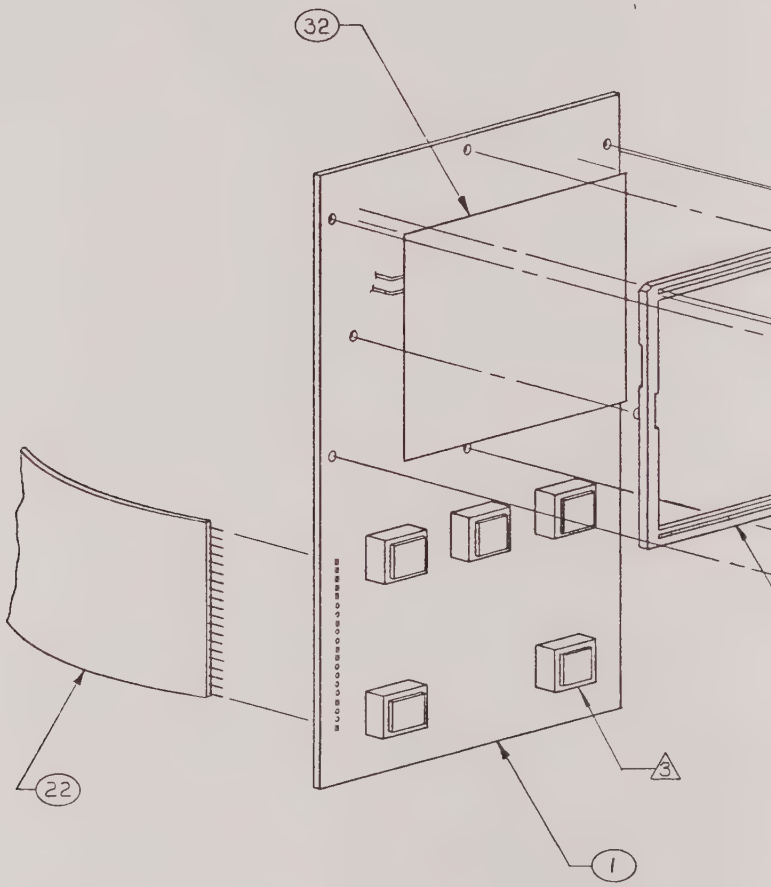
SCA 5-4

SHEET ___ OF ___

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1663049002
DESCRIPTION: FRONT PNL ASSY, RATE
REF DES

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 1662651001 | BEZEL, PAINTED FRNT. PNL, 9020 9023 | | 1 |
| 002 | 1661866502 | PWA, FRNT PNL, 9023 | | 1 |
| 003 | 1661250501 | PWA, TEMP. CONT 1-CHNL | | 1 |
| 005 | 1661724101 | BRKT, MTG, UPPER | | 1 |
| 006 | 1661723101 | BRKT, MTG, LOWER | | 1 |
| 008 | 1501865 | SUPPORT PCB NYLON LOCK-3/8 SPACE | | 1 |
| 010 | 1662698101 | LABEL"DELTA LOGO" | | 1 |
| 011 | 1662684102 | LABEL, LOGO-9020 | | 1 |



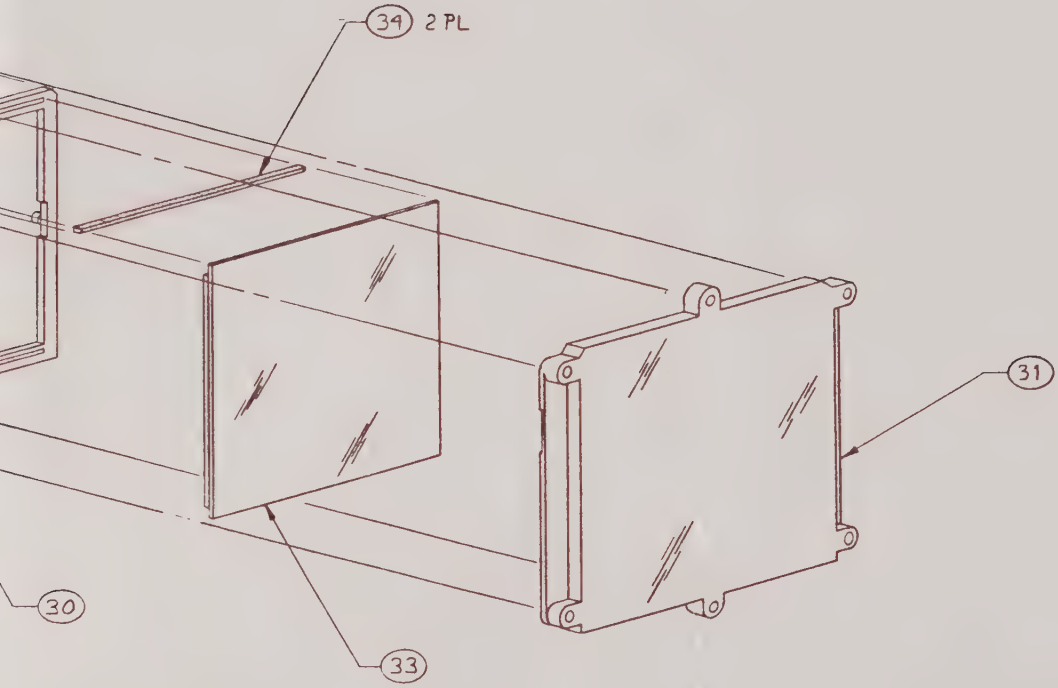

3 DO NOT USE SOLVENT ON SW1-SW5

2 FINISH (IF APPLICABLE)

1 MATL (IF APPLICABLE)

DIMS: UNLESS OTHERWISE SPECIFIED

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPD |
| | A | [illegible] 7363 | | |
| | B | ECN 7397 | 11-15-87 | |
| | C | ECN 7447 | | |
| | D | ADDED NOTE 3. | 12-10-87 | |





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UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0° 30'
HOLE TOLERANCES
.013 +.004 −.001 THRU .125
.126 +.005 −.001 THRU .250
.251 +.006 −.001 THRU .500
.501 +.008 −.001 THRU .750

ENGINEERING ACTIVITY: ERN 7363

| | |
|---|---|
| DESIGN | |
| DRAFTED | T. SHEPARD 12-22-86 |
| CHECKED | |
| APPROV | |
| RELEASE | |

DO NOT SCALE DWG


9775 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111


TITLE: PWA – FRONT PANEL

| SIZE | CODE IDENT | REV |
|---|---|---|
| D | 16616 | L |

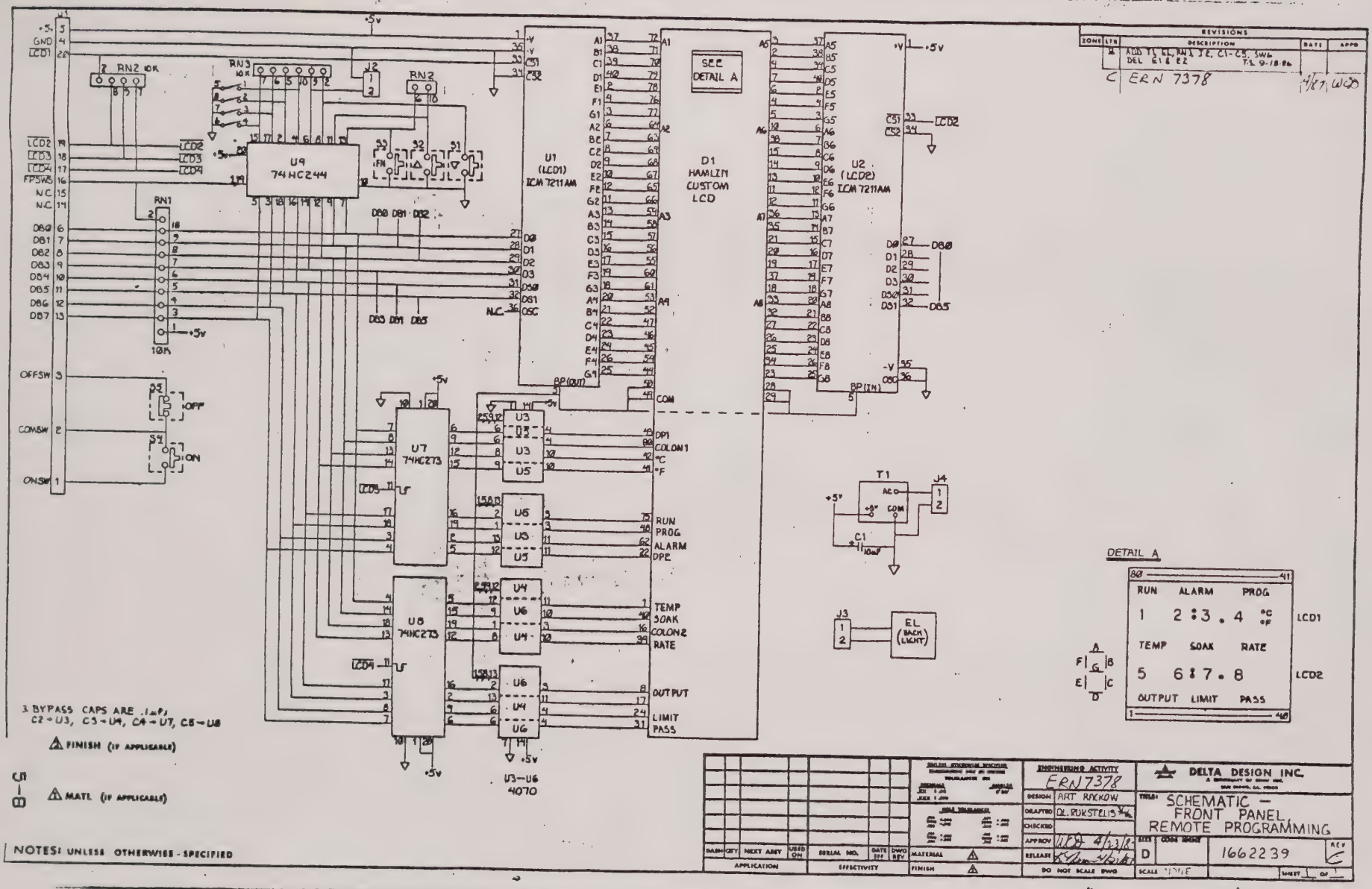
SCALE 5-6 SHEET _ OF _

| DASH | QTY | NEXT ASSY | USED ON | SERIAL NO. | DATE EFF | DWG REV |
|---|---|---|---|---|---|---|
| APPLICATION | | | | EFFECTIVITY | | |

MATERIAL ⚠1
FINISH ⚠4

PARTS LIST BY ITEM
ASSEMBLY 1661866502
DESCRIPTION PWA, FRNT PNL, 9020
REF/DES

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 1661865401 | PWB FRONT PANEL 9010, 9020 | | 1 |
| 003 | 1662239000 | SCHEMATIC FRONT PNL RATE PROGRAMMES | | REF |
| 005 | 1000581 | IC 4 DIGIT DISPLAY DECODER DRIVER ICM7211AMIPL | U1, U2 | 2 |
| 006 | 1000580 | IC EXCEL/GATE 4070 | U3-U6 | 4 |
| 007 | 1000579 | IC D-TYPE FLIP-FLOP 74HC273 | U7, U8 | 2 |
| 008 | 1000538 | IC | U9 | 1 |
| 012 | 0700000 | CAP 10MFD 25VDC TANTALUM | C1 | 1 |
| 013 | 0800022 | CAP CERAMIC .1MFD 50V 20% RADIAL LEAD | C2-C5 | 4 |
| 017 | 0400100 | RES NTWK SIP 10K | RN1-RN3 | 3 |
| 020 | 1401298 | SWITCH PB SPDT PCB MTG | SW1-SW5 | 5 |
| 021 | 1401188 | SWITCH DIP SPST PCB 4 POS | SW6 | 1 |
| 022 | 1500373 | CABLE ASSY FLAT FLEX .100CTR 20 POS JUMPR | J1 | 1 |
| 023 | 2000398 | CONN HDR STR 100 PCB 2P | J2-J4 | 3 |
| 025 | 1000582 | IC INVERTER DC-AC 3 TO 6.25VDC 120mA INPUT LPS05-1-2 | T1 | 1 |
| 028 | 1666279001 | CABLE ASSY-BACKLIGHT | | 1 |
| 030 | 1661705101 | RETAINER, LCD CONN | | 1 |
| 031 | 1661706101 | BEZEL, LCD | | 1 |
| 032 | 1663519101 | BACKLIGHT, LCD | | 1 |
| 033 | 1663520102 | DISPLAY LCD | | 1 |
| 034 | 2000434 | CONNECTOR LCD(ZEBRA) | | 2 |

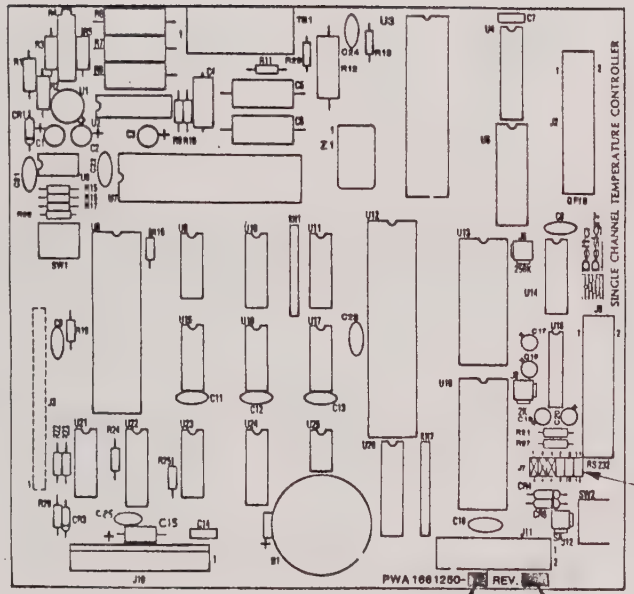

REVISIONS
ZONE LTR DESCRIPTION DATE APPD
C ERN 7378 4/87 WCD
U9 74HC244
U1 (LCD1) ICM 7211AM
U2 (LCD2) ICM 7211AM
D1 HAMLIN CUSTOM LCD
SEE DETAIL A
U7 74HC273
U8 74HC273
U3–U6 4070
T1
J4
C1
J3
EL (BACK LIGHT)
OFFSW
COMSW
ONSW
OFF
ON
DETAIL A
RUN ALARM PROG
1 2:3.4
LCD1
TEMP SOAK RATE
5 6:7.8
LCD2
OUTPUT LIMIT PASS
3 BYPASS CAPS ARE .1uF, C2–U3, C3–U4, C4–U7, C5–U8
FINISH (IF APPLICABLE)
MATL (IF APPLICABLE)
NOTES: UNLESS OTHERWISE SPECIFIED
ENGINEERING ACTIVITY
ERN7378
DESIGN ART RACKOW
DRAFTED D. RUKSTELIS
CHECKED
APPROV
RELEASE
DO NOT SCALE DWG
DELTA DESIGN INC.
SCHEMATIC — FRONT PANEL REMOTE PROGRAMMING
SIZE D
1662239
REV C
SCALE NONE
SHEET 1 OF 1

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1666279001
DESCRIPTION: CABLE ASSY-BACKLIGHT
REF/DES:

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 2000461 | COVER, STRAIN RELIEF<br>2 CKTS MTA-100 | | 2 |
| 002 | 2000405 | CONN PLG 2P 22G 100 | P3, P4 | 2 |
| 003 | 1500365109 | WIRE, 22 GA GRAY | | |
| 004 | 1500365103 | WIRE, 22 GA ORANGE | | |

| REV | DESCRIPTION | APPROVED | DATE |
|---|---|---|---|
| A | REVISED - ADDED Z1 R29 | T.S. 7-1-86 | |
| B | ERN 7363 | | 7/18/86 |
| C | ECN 7392 | T.S 4-6-87 | 4/14/87 |
| D | ECN 7514 | T.S. 3-25-87 | 4-7-88 |




J7 1 3 5 7 9 11 / 2 4 6 8 10 12 — JUMPERS (3) ARE VERTICAL

-501

J7 1 3 5 7 9 11 / 2 4 6 8 10 12 — JUMPERS (2) ARE HORIZONTAL

-502, -503

ORIENTATION OF JUMPERS, ITEM 79, FOR J7

5-10

(2) MARK CORRECT DASH NO (-50X), WHERE SHOWN, USING BLACK INDELIBLE INK.

(1) MARK CURRENT REV LEVEL OF ASSY DWG USING BLACK INDELIBLE INK, WHERE SHOWN.

NOTES: UNLESS OTHERWISE SPECIFIED

| DASH | QTY | NEXT ASSY | USED ON | SERIAL NO. | DATE EFF | DWG REV |
|---|---|---|---|---|---|---|
| 503 | 1 | 1663099-003 | | | | |
| 502 | 1 | 1663099-002 | | | | |
| 501 | 1 | 1663099-001 | MARK I | | | |

APPLICATION — EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ±.03; .XXX ±.010
ANGLES: 0°30'

HOLE TOLERANCES

| | | | |
|---|---|---|---|
| .013 THRU .120 | +.004 -.001 | .251 THRU .390 | +.006 -.001 |
| .176 THRU .320 | +.003 -.001 | .391 THRU .750 | +.006 -.001 |

MATERIAL (1)

FINISH (2)

ENGINEERING ACTIVITY: ERN 7363

| | | |
|---|---|---|
| DESIGN | | |
| DRAFTED | T. SHEPARD | 7-1-86 |
| CHECKED | | |
| APPROV | | 4/8/86 |
| RELEASE | | 4/17/86 |

DO NOT SCALE DWG

DELTA DESIGN INC.
A SUBSIDIARY OF COMU INC.
SAN DIEGO, CA. 92123

TITLE: PWA — SINGLE CHANNEL TEMPERATURE CONTROLLER

| SIZE | CODE IDENT | | REV |
|---|---|---|---|
| C | | 1661250 | D |

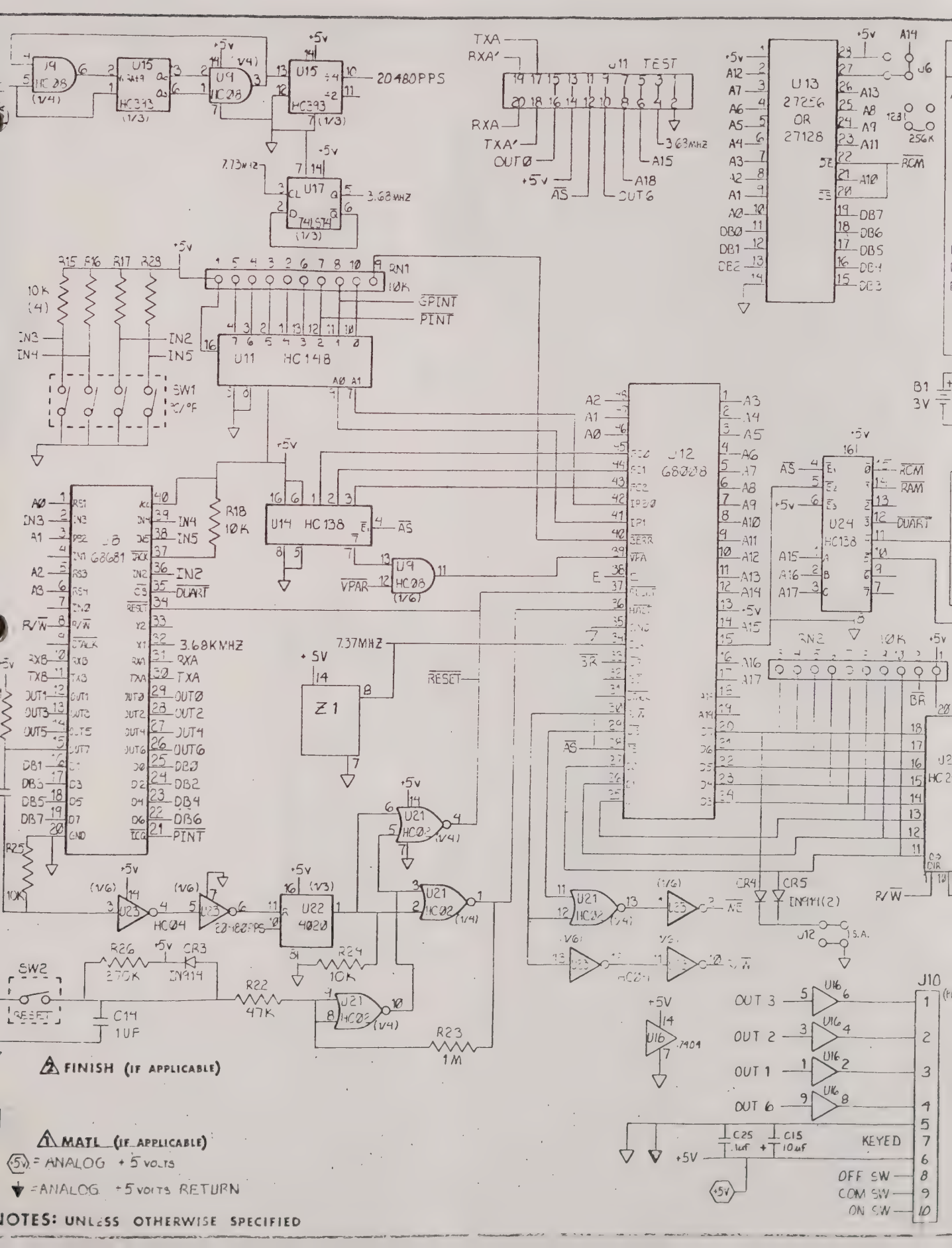
SCALE 1/1 — SHEET 1 OF 1

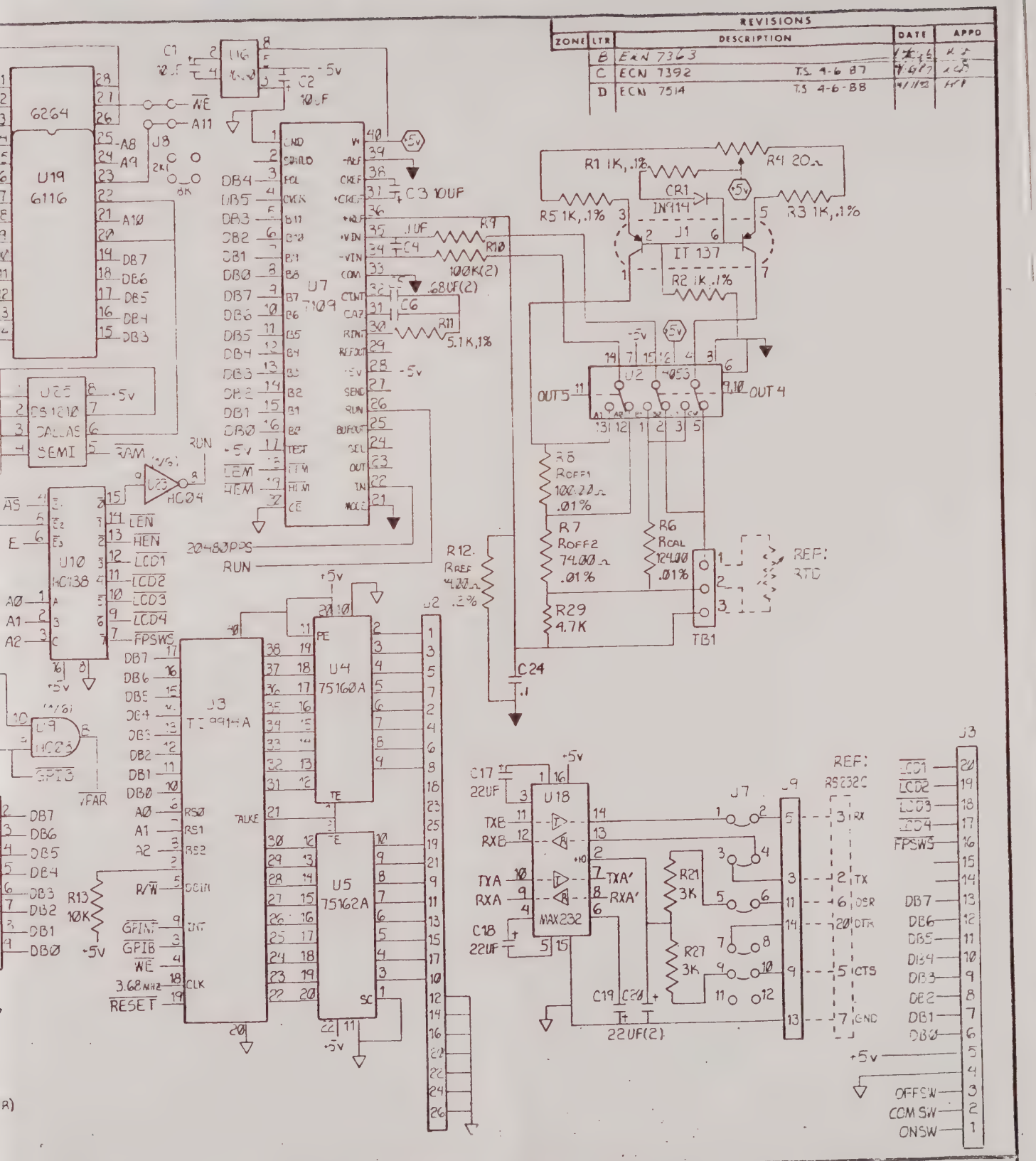
PARTS LIST BY ITEM
ASSEMBLY: 1661250501
DESCRIPTION PWA, TEMP. CONT, 1-CHNL
REF/DES

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 1661249401 | PWB, TEMP. CONT 1-CH | | 1 |
| 003 | 1661247000 | SCHEMATIC SGL CHAN TEMP CONTR | | REF |
| 005 | 1206537 | XSTR DUAL PNP IC13 | U1 | 1 |
| 006 | 1000577 | IC TRIPLE 2-CH ANA MULTIPLEXER/DEMULTI-PLEXER 4053 | U2 | 1 |
| 007 | 1000549 | IC GPIB CONTR TMS9914A | U3 | 1 |
| 008 | 1000547 | IC GPIB DRIVER SN75160A | U4 | 1 |
| 009 | 1000546 | ICC GPIB DRVR SN7516 GPIB DRVRX | U5 | 1 |
| 010 | 1000514 | IC ICL7660 CPA | U6 | 1 |
| 011 | 1000566 | IC A/D CONV 12-BIT ICL7109CPL | U7 | 1 |
| 012 | 1000521 | IC 68681 | U8 | 1 |
| 013 | 1000539 | IC DECODER 3 LINE TO 8 LINE 74HC138 | U10, U14, U24 | 3 |
| 014 | 1000537 | IC ENCODER 8 TO 3 LINE PRIORITY 74HC148 | U11 | 1 |
| 015 | 1000525 | IC 68008 | U12 | 1 |
| 016 | 1664605001 | IC, PROGRAMMED | U13 | 1 |
| 017 | 1000563 | IC DUAL SYNCH BIN COUNTER 74HC393 | U15 | 1 |
| 018 | 1000165 | IC, SN7407 | U16 | 1 |
| 019 | 1000179 | IC SN74LS74A | U17 | 1 |
| 020 | 1000576 | IC +5V DUAL RS-232 XMTR/RCVR MAX 232CPE | U18 | 1 |
| 021 | 1000565 | IC SRAM 150NS UPD4464C-15L | U19 | 1 |
| 022 | 1000523 | IC 74HC02 | U21 | 1 |
| 023 | 1000527 | IC CD4020 | U22 | 1 |
| 024 | 1000564 | IC HEX INV 74HC04 | U23 | 1 |
| 025 | 1000578 | IC NONVOLATILE CON-TROLLER DS1210 | U25 | 1 |
| 026 | 1000562 | IC OCTAL BUS XCVR NON INV 74HC245 | U26 | 1 |
| 027 | 1000561 | IC AND GATE QUAD 2 INPUT 74HC08 | U9 | 1 |
| 030 | 0701000026 | CAP TANTALUM 10MFD 25V | C1, C2, C3 | 3 |
| 031 | 0800033 | CAP METAL POLYPROP .10MF 100V | C4 | 1 |
| 032 | 0800035 | CAP METAL POLYPROP .68MFD 100V | C5, C6 | 2 |
| 033 | 0800022 | CAP CERAMIC .1MFD 50V 20% RADIAL LEAD | C7, C8, C11-13, C16, | 10 |
| 034 | 0800032 | CAP CERAMIC 1 MFD 100V | C14 | 1 |
| 035 | 0700000 | CAP 10MFD 25VDC TANTALUM | C15 | 1 |

PARTS LIST BY ITEM
ASSEMBLY: 1661250501
DESCRIPTION: PWA, TEMP. CONT, 1-CHNL
REF/DES

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 036 | 0800024 | CAP, 22UF, TANT | C17-C20 | 4 |
| 037 | 0800051 | CAP CERAMIC .01MFD 50V 20% RADIAL | C9 | 1 |
| 040 | 1421100114 | RES METAL FILM 1 O K 1/4W 0.1% | R1-R3, R51 | 4 |
| 041 | 0500066102 | POT, 20 OHM | R4 | 1 |
| 042 | 0400127 | RES PREC WIREWOUND 124 OHM 1/2W .01% | R6 | 1 |
| 043 | 0400126 | RES PREC WIREWOUND 74 OHM 1/2W .01% | R7 | 1 |
| 044 | 0400125 | RES PREC WIREWOUND 100 OHM 1/2W .01% | R8 | 1 |
| 045 | 0310034500 | RES, 100K, 1/4W, 5% | R9, R10 | 2 |
| 046 | 1421499114 | RES METAL FILM 4.99K 1/4W 1% | R11 | 1 |
| 047 | 0400124 | RES PREC WIREWOUND 14 OHMS 1/2W .01% | R12 | 1 |
| 048 | 0301034500 | RES 10K 1/4W 5% | R13, R15-R19, R24, R25, | 9 |
| 049 | 1410370184 | RES FIXED FILM 3K 1/4W 5% | R21, R27 | 2 |
| 050 | 1410370212 | RES FIXED FILM 47K 1/4W 5% | R22 | 1 |
| 051 | 1410370244 | RES, FIXED FILM 1MEG 1/4W 5% | R23 | 1 |
| 052 | 1410370230 | RES FIXED FILM 270K 1/4W 5% | R26 | 1 |
| 053 | 0304724500 | RES, 4.7K, 1/4W, 5% | R29 | 1 |
| 054 | 0400100 | RES NTWK SIP 10K | RN1, RN2 | 2 |
| 058 | 1100914 | DIODE 1N914 | CR1, CR3, CR4, CR5 | 4 |
| 060 | 1401305 | OSC XTAL TTL CLOCK 7.3728 MHZ | Z1 | 1 |
| 063 | 1401188 | SWITCH DIP SPST PCB 4 POS | SW1 | 1 |
| 064 | 1401295 | SWITCH PB PCB | SW2 | 1 |
| 068 | 1401300 | BATTERY LITHIUM 3V | B1 | 1 |
| 072 | 2000338 | CONN, PWB, MALE HEADER | J2, J9 | 2 |
| 073 | 2000428 | CONN RCPT SIP STRIP 20 PIN PCB MTG 01DSP | J3 | 1 |
| 074 | 2000427 | CONN HDR STR 156 SP PCB MTG 10 POS 045SQ | J10 | 1 |
| 075 | 2000348 | CONNECTOR, MLE 20 PIN | J11 | 1 |
| 076 | 2000403 | CONN HDR STPLN STR DBL .100 | J7, J12 | 8 |
| 077 | 1400397 | TERMINAL BLOCK 3POS PCB MTG SINGLE POST .375 SPACING | TB1 | 1 |
| 080 | 2500089104 | SOCKET, DIP, 16 PIN | XU22 | 1 |
| 081 | 2500089106 | SOCKET, DIP, 20 PIN | XU26 | 1 |
| 082 | 2500089109 | SOCKET, DIP, 28 PIN | XU13 | 1 |


20480PPS
3.68MHZ
7.37MHZ
RESET
GPINT
PINT
SW1
°C/°F
SW2
RESET
C14
1UF
R18
10K
R22
47K
R23
1M
R24
10K
R25
10K
R26
270K
CR3
IN914
U13
27256
OR
27128
RCM
DUART
RAM
KEYED
OFF SW
COM SW
ON SW
OUT 1
OUT 2
OUT 3
OUT 6
TXA
RXA
TXA'
RXA'
OUTØ
A15
A18
OUT6
TEST
FINISH (IF APPLICABLE)
MATL (IF APPLICABLE)
= ANALOG +5 VOLTS
= ANALOG +5 VOLTS RETURN
NOTES: UNLESS OTHERWISE SPECIFIED

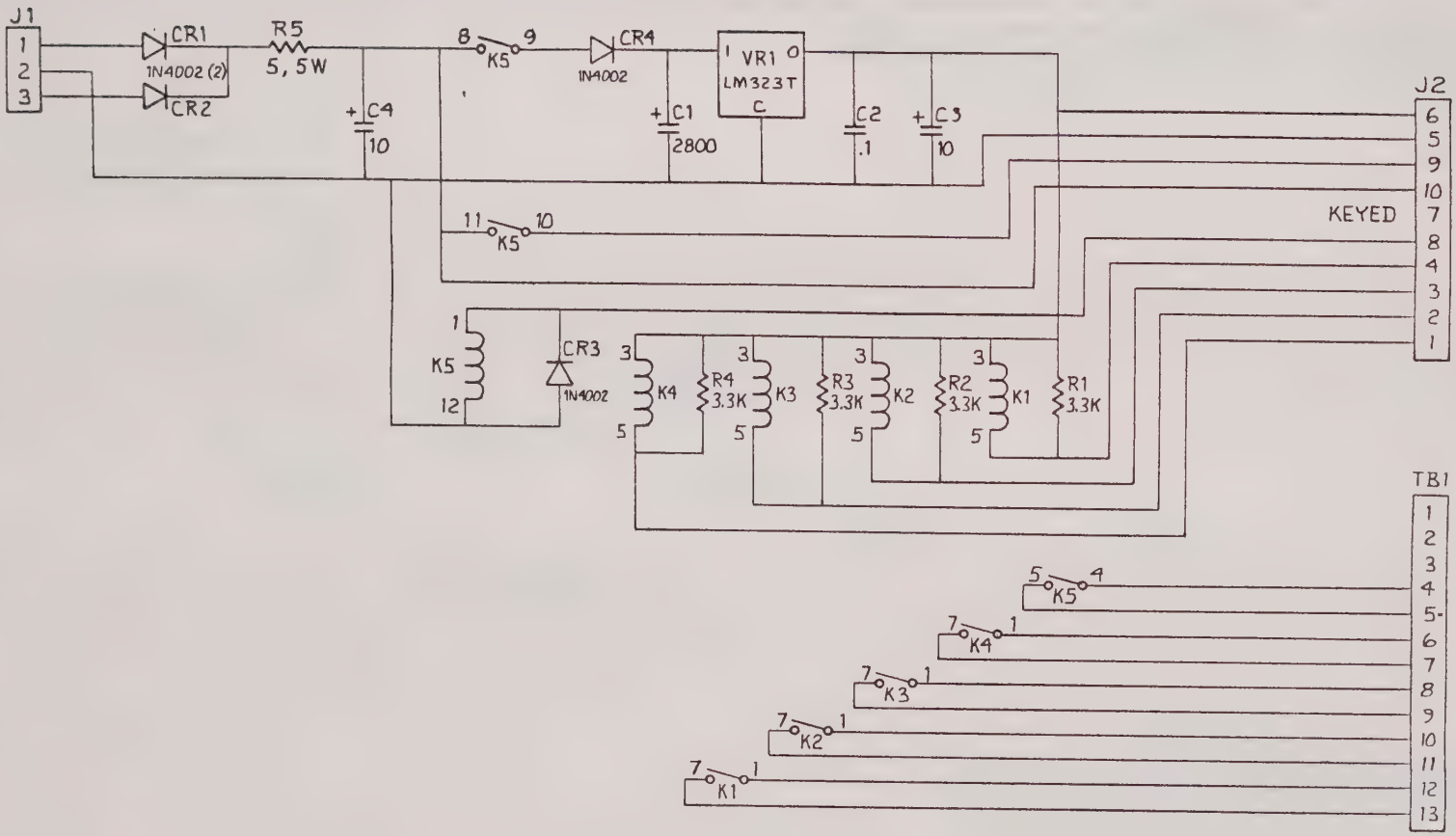

REVISIONS
ZONE LTR DESCRIPTION DATE APPD
B ERN 7363
C ECN 7392 TS 4-6 87
D ECN 7514 TS 4-6-88
6264
U19
6116
U16
7805
C1
C2
10UF
+5v
WE
A11
A8
A9
A10
DB7
DB6
DB5
DB4
DB3
U8
2K
8K
U22
DS1210
DALLAS
SEMI
RAM
U23
HC04
RUN
U7
7109
C3 10UF
.1UF
C4
100K(2)
.68UF(2)
C6
R11
5.1K,1%
R9
R10
20480PPS
RUN
R1 1K,.1%
R4 20Ω
CR1
IN914
R5 1K,.1%
R3 1K,.1%
J1
IT 137
R2 1K,.1%
U2
4053
OUT 5
OUT 4
R8
ROFF1
100.20Ω
.01%
R7
ROFF2
74.00Ω
.01%
R6
RCAL
124.00Ω
.01%
R29
4.7K
TB1
REF:
RTD
R12.
RREF
4.00Ω
.2%
C24
.1
U10
HC138
AS
E
A0
A1
A2
LEN
HEN
LCD1
LCD2
LCD3
LCD4
FPSWS
U9
HC23
GPIB
PAR
U3
TI 9914A
U4
75160A
U5
75162A
R13
10K
R/W
GPIB
WE
3.68MHz
RESET
U18
MAX232
TXB
RXB
TXA
RXA
TXA'
RXA'
C17
22UF
C18
22UF
C19
C20
22UF(2)
R21
3K
R27
3K
REF:
RS232C
RX
TX
DSR
DTR
CTS
GND
J3
OFFSW
COMSW
ONSW

| | | |

PARTS LIST BY ITEM
ASSEMBLY: 1663606501
DESCRIPTION: PWA-RATE PRG RELAY
REF/DES:

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 1663605401 | PWB-RATE PRG RELAY | | 1 |
| 003 | 1663604000 | SCHEMATIC RATE PROG-RAMMER RELAY | | REF |
| 005 | 1000586 | IC POS VOLT REG 5V 3A LM323T | VR1 | 1 |
| 007 | 0303324500 | RES, 3.3K, 1/4W, 5% | R1-R4 | 4 |
| 008 | 0400128 | RES WIREWOUND 2 OHM 5W 5% | R5 | 1 |
| 010 | 0800053 | CAP ALUM ELECTRO 2800MFD 25WVDC-10+75% | C1 | 1 |
| 011 | 0800022 | CAP CERAMIC .1MFD 50V 20% RADIAL LEAD | C2 | 1 |
| 012 | 0701000026 | CAP TANTALUM 10MFD 25V | C3, C4 | 2 |
| 015 | 1104002 | DIODE, 1N4002 | CR1-CR4 | 4 |
| 018 | 1400317 | RELAY REED 1FORMA SPST-NO 10VA .5A/100 VDC | K1-K4 | 4 |
| 019 | 1400442 | RELAY 4 FORMA 12VDC 200mW 4A250VAC 3A30VDC PC MTG | K5 | 1 |
| 022 | 1400448 | TERMINAL BLOCK 13 PIN 300V 20A PCB | TB1 | 1 |
| 025 | 2000424 | CONN HDR STR 156SP 3POS 045SQ PIN LOCK | J1 | 1 |
| 029 | 2000427 | CONN HDR STR 156 SP PCB MTG 10 POS 045SQ | J2 | 1 |
| 030 | 1500201 | HEATSINK FOR PLASTIC POWER DEVICE | | 1 |
| 031 | 4100758 | STANDOFF PCB MTG 6-32 THRU 1/4"LONG METAL | | 5 |
| 032 | 1500200 | HEATSINK FOR PLASTIC POWER DEVICE | | 1 |

| ZONE | LTR | DESCRIPTION | DATE | APPD |
|---|---|---|---|---|
| | B | REDESIGNED T.S. 2-18-87<br>ERN 7400 | 4/27/87 | WCS |





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5-16

⚠ ALL CAPACITORS ARE IN MICROFARADS.

⚠ ALL RESISTORS ARE IN OHMS AND ARE 1/4 W, EXCEPT R5, 5W.

NOTES: UNLESS OTHERWISE SPECIFIED

| DASH | QTY | NEXT ASSY | USED ON |
|---|---|---|---|
| 000 | REF | 1663606 | 9020 |

APPLICATION

SERIAL NO. | DATE EFF | DWG REV

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03, .XXX ± .010
ANGLES 0°30'
HOLE TOLERANCES
.013 THRU .128 +.006 -.001
.251 THRU .500 +.006 -.001
.126 THRU .250 +.003 -.001
.501 THRU .750 +.006 -.001

MATERIAL

FINISH

| ENGINEERING ACTIVITY | |
|---|---|
| | ERN 7400 |
| DESIGN | |
| DRAFTED | T.SHEPARD 2-18-87 |
| CHECKED | |
| APPROV | WCS 4/27/87 |
| RELEASE | 11/24/87 |

DO NOT SCALE DWG

Delta Design
5775 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111

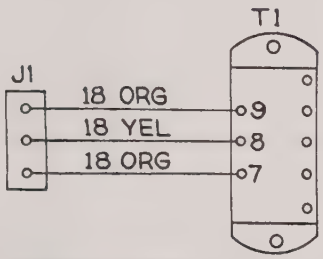
TITLE: SCHEM — RATE PROGRAMMER RELAY

| SIZE | CODE IDENT | | REV |
|---|---|---|---|
| C | | .1663604 | C |

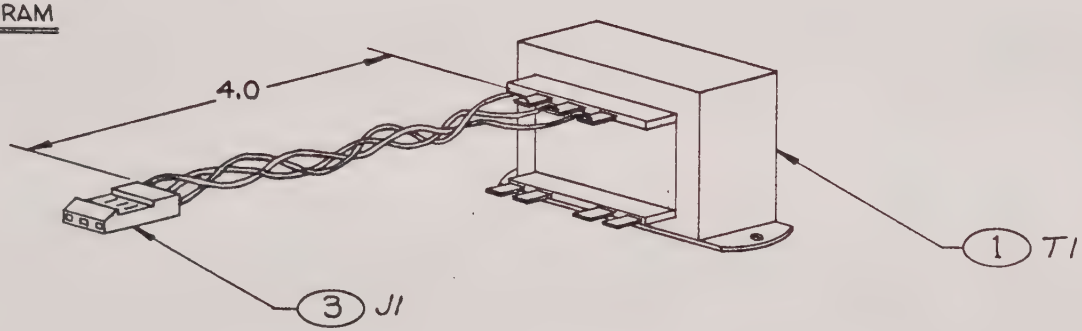
SCALE NONE

SHEET 1 OF 1

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPD |
| | A | ERN 7378 | 4/23/87 | WCD |
| | B | ECN 7414 | 6-11-87 | WCD |




WIRING DIAGRAM





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| DASH | QTY | NEXT ASSY | USED ON |
|---|---|---|---|
| 001 | 1 | 1664477 | 9030 |

APPLICATION

SERIAL NO. | DATE EFF | DWG REV

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ±.05 .XXX ±.010
ANGLES 0°30'
HOLE TOLERANCES

MATERIAL SEE PL

FINISH

ENGINEERING ACTIVITY ERN 7378

| | | |
|---|---|---|
| DESIGN | | |
| DRAFTED | E. SAMSON 4-87 | |
| CHECKED | | |
| APPROV | WCD | 4/23/87 |
| RELEASE | K. Yamamoto | 4/24/87 |

DO NOT SCALE DWG

Delta Design
A Cohu Company
5775 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111

TITLE: TRANSFORMER ASSY

SIZE B | 1665275 | REV. B

SCALE — | SHEET __ OF __

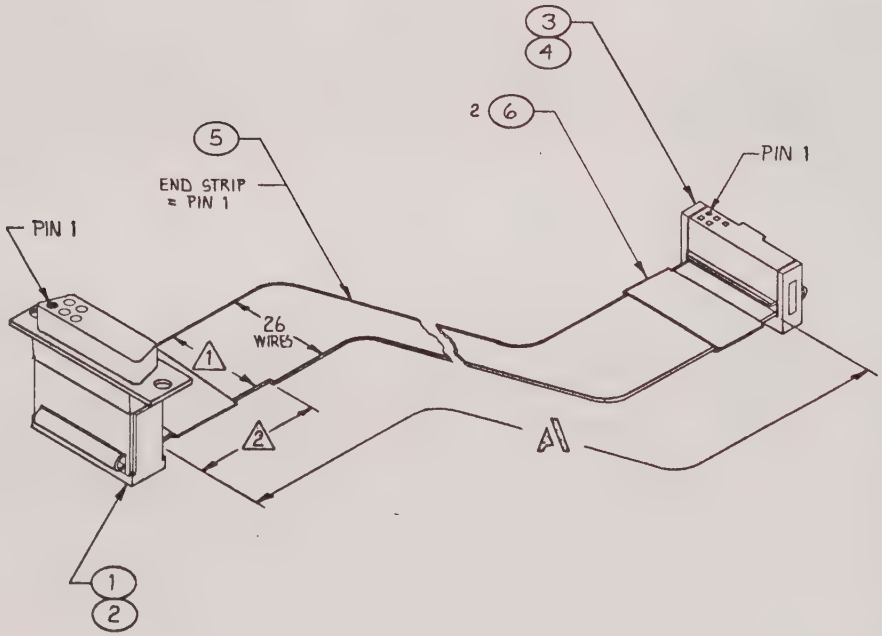
NOTES: UNLESS OTHERWISE SPECIFIED

PARTS LIST BY ITEM
ASSEMBLY 1665275001
DESCRIPTION: TRANSFORMER ASSY
REF/DES

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 1400291 | TRANSFORMER POWER<br>DUAL 115/230V PRI<br>20V CT @ 105A SEC | | 1 |
| 003 | 2000435 | CONNECTOR RECT LOCK-<br>ING 3 PIN 18 AWG<br>156SP 045 SQ | | 1 |

| NO. | IN INCHES | |
|---|---|---|
| 001 | 12 | GPIB CONN |
| 002 | 14 | |
| 003 | 16 | |
| 010 | 30 | |
| 020 | 50 | |
| 030 | 70 | |
| 040 | 90 | |
| 050 | 110 | |
| 051 | 12 | RS-232C CONN |
| 052 | 14 | |
| 053 | 16 | |
| 060 | 30 | |
| 070 | 50 | |
| 080 | 70 | |
| 090 | 90 | |
| 095 | 100 | |

| REV | DESCRIPTION | DATE |
|---|---|---|
| A | ERN 7378 | 4/23/87 WKK |





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5-19

⚠ ——→ WIRE(S) TO BE CUT 1.5 INCHES FROM END OF CABLE.

⚠ ——→ GPIB USES 24 WIRES AND RS-232C USES 25 WIRES.

NOTES: UNLESS OTHERWISE SPECIFIED

| DASH | QTY | NEXT ASSY | USED ON |
|---|---|---|---|
| | | MULTI | |

APPLICATION

SERIAL NO. | DATE EFF | DWG REV

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0° 30'

HOLE TOLERANCES
.013 THRU .129 +.004 −.001
.131 THRU .500 +.006 −.001
.126 THRU .359 +.002 −.001
.501 THRU .750 +.006 −.001

MATERIAL ⚠

FINISH ⚠

| ENGINEERING ACTIVITY | |
|---|---|
| ERN 7378 | |
| DESIGN | |
| DRAFTED | T. SHEPARD 3-2-87 |
| CHECKED | |
| APPROV | WKK 4/23/87 |
| RELEASE | K. Hamm 4/27/87 |

DO NOT SCALE DWG


Delta Design
A Cohu Company
5775 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111


TITLE: CABLE ASSY — GPIB / RS-232C

| SIZE | CODE IDENT | | REV |
|---|---|---|---|
| C | | 1664574 | A |

SCALE NONE

SHEET 1 OF 1

DELTA DESIGN

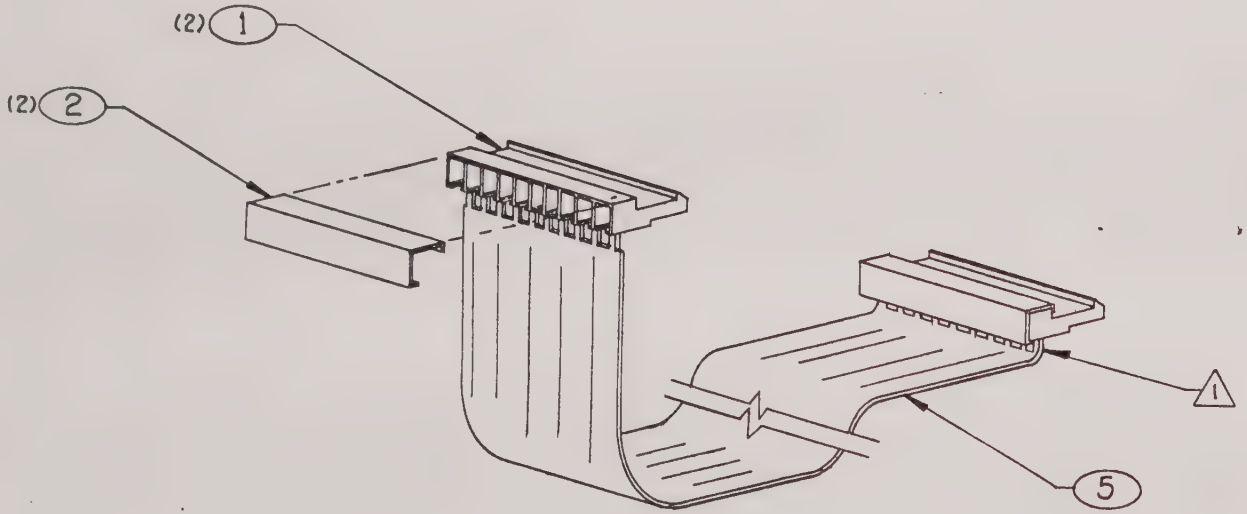
PARTS LIST BY ITEM
ASSEMBLY 1664574001
DESCRIPTION: CABLE ASSY, GPIB, 12"
REF/DES

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 2000448 | CONN RIBBON FEMALE PNL MTG 24 PIN (GPIB) | | 1 |
| 002 | 1700450 | JACK SOCKET ASSY METRIC (GPIB) | | 2 |
| 003 | 1410111105 | CONN, FEMALE, POLARIZE FLAT CABLE, 26 POS | | 1 |
| 004 | 1410449105 | STRAIN RELIEF FLAT CABLE, 26 POS | | 1 |
| 005 | 1410035109 | CABLE, FLAT 28 AWG, 26 CONDUCTORS | | 12 |
| 006 | 1500521 | LABEL CABLE MARKING 1 IN X 3-3/4 IN SELF LAMINATING | | 2 |

PARTS LIST BY ITEM
ASSEMBLY: 1664574051
DESCRIPTION: CABLE ASSY, RS232, 12"
REF/DES

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 2000446 | CONN D-STYLE FEMALE<br>25 SOCKETS<br>(RS-232) | | 1 |
| 002 | 1700449 | JACK SOCKET ASSY<br>REAR PNL MOUNT | | 1 |
| 003 | 1410111105 | CONN, FEMALE, POLARIZE<br>FLAT CABLE, 26 POS | | 1 |
| 004 | 1410449105 | STRAIN RELIEF<br>FLAT CABLE, 26 POS | | 1 |
| 005 | 1410035109 | CABLE, FLAT<br>28 AWG, 26 CONDUCTORS | | 12 |
| 006 | 1500521 | LABEL CABLE MARKING<br>1 IN X 3-3/4 IN<br>SELF LAMINATING | | 2 |

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPD |
| | A | ERN 7378 | 4/23/87 | WKD |

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⚠1 CUT CABLE ENDS IN MIDDLE OF NOTCHES

| DASH | QTY | NEXT ASSY | USED ON |
|---|---|---|---|
| 001 | / | MULTI | CH |

APPLICATION

SERIAL NO. | DATE EFF | DWG REV

EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0°30'
HOLE TOLERANCES
.015 THRU .125 +.004 −.001
.126 THRU .250 +.005 −.001
.251 THRU .500 +.006 −.001
.501 THRU .750 +.006 −.001

MATERIAL —
FINISH —

ENGINEERING ACTIVITY: ERN 7378

| | | |
|---|---|---|
| DESIGN | | |
| DRAFTED | E. SAMSON 3-87 | |
| CHECKED | | |
| APPROV | WKD | 4/23/87 |
| RELEASE | [signature] | 4/27/87 |

DO NOT SCALE DWG

Delta Design, A Coin Company
8775 KEARNY VILLA RD.
SAN DIEGO, CA
92123-1111

TITLE: CABLE ASSY- AUX MOD TO TEMP. CONT.

SIZE B | 1664861 | REV. A

SCALE 1/1 | SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

5-22

DELTA DESIGN

PARTS LIST BY ITEM
ASSEMBLY: 1664861001
DESCRIPTION: CABLE ASSY-AUX MOD
REF/DES:

| ITEM | PART NO. | DESCRIPTION | REF/DES | QTY |
|---|---|---|---|---|
| 001 | 2000449 | CONN RECT LCKNG 10 PIN 156 SP 22 AWG | | 2 |
| 002 | 2000456 | COVER, STRAIN RELIEF 10 CKTS MTA-156 | | 2 |
| 005 | 1664741101 | CABLE ROUND COND FLT .156 CTR 10 CKT PRE-NOTCHED 22AWG | | 15 |

MP MASTER
MA32847